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MANPOWER ANALYSIS
MUNICIPAL WASTEWATER TREATMENT FACILITIES IN NEW ENGLAND

NEW ENGLAND BOARD OF HIGHER EDUCATION

PREPARED FOR
ENVIRONMENTAL PROTECTION AGENCY

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

UNDER A GRANT TO

STUDENT INTERNSHIPS IN ECONOMIC DEVELOPMENT PROGRAM

NEW ENGLAND BOARD OF HIGHER EDUCATION

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FOREWORD

Major financial support for the Student Internship in Economic Development program comes from the New England Regional Commission (NERCOM), direct costs for this project were borne by the United States Environmental Protection Agency (EPA) through a Manpower Planning Grant from that Agency.

This report represents the work of a student or students in the New England Board of Higher Education's (NEBHE) Student Internship in Economic Development (SIED) program. The objective of this program is to relate the resources of institutions of higher education to economic development organizations in such a was as to:

- assist economic development organizations in the investigation and solution of selected, well-defined problems through the use of student manpower; and
- permit students to enrich their formal learning through concrete service experience in economic development; and
- aid in the assessment of the environmental impact of economic development projects in the region.

This program thus represents one component of NEBHE's continuing effort to assist the New England State governments and the public and private institutions of higher education in their effort to expand the quantity and quality of educational opportunity. The New England Board of Higher Education was created in 1955 by a six-state compact and ratified by Congress. It is thus the official regional agency of these states for this purpose and related functions.

The findings, conclusions and recommendations contained herein are those of the author(s) and do not necessarily represent those of the local organizations, participating universities, EPA, NERCOM, NEBHE, or the SIED staff. They are, in effect, the students' contribution to the continuing processes of economic and social growth in the New England region.

ACKNOWLEDGEMENTS

At different stages of the study, many people rendered assistance for which we are indebted. Above all, the operators and other individuals employed in the industry were very helpful and cooperative in providing the basic data needed for this study.

The interns are grateful for the suggestions from Professor Blanche Fitzpatrick, Associate Professor of Boston University and advisor for our study; Mr. Norman Stein and Mr. Daniel Ranalli, New England Board of Higher Education; Mr. Edgar Bernard, Mr. Michael MacDougall, Mr. William Walsh, and Mr. Richard Kotelli, United States Environmental Protection Agency; and Mr. Robert Prolman , New England Interstate Water Pollution Control Commission.

Appreciation is also expressed for the cooperation of the personnel of the Maine Water and Air Environmental Improvement Commission; the New Hampshire Water Supply and Pollution Control Commission; the Vermont Department of Water Resources; the Massachusetts Department of Natural Resources, Division of Water Pollution Control; the Connecticut State Water Resources Commission; and the Rhode Island Department of Health, Division of Water Supply and Pollution Control.

Mrs. Mildred Butterfield, Ms. Lenor Kirkeby and Ms. Susan Burpee performed many various and thankless tasks for which we are particularly indebted.

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ABSTRACT

This survey portrays the situation with respect to manpower of wastewater treatment plants in the six New England states during the summer of 1972. Universal coverage of municipal treatment plants in Connecticut, Massachusetts, Rhode Island, Maine, Vermont and New Hampshire was obtained through plant site visits. Information on labor force characteristics was gathered and analyzed. Projections for future manpower needs in the industry were made. Data on the number and type of training courses available to the operator was also obtained.

INTRODUCTION

Manpower Analysis: Municipal Wastewater Treatment Facilities In New England is the result of a study conducted during the summer of 1972 by four doctoral candidates in economics and two baccalaureate candidates at Boston Univeristy. The study was carried out under the supervision of Dr. Blanche Fitzpatrick, Associate Professor of Economics at Boston University. Funds were provided by grant number 900171 from the United States Environmental Protection Agency and were administered through the New England Board of Higher Education.

The survey studies characteristics of the work force in wastewater treatment plants in the six New England states. Universal coverage of municipal treatment plants in Connecticut, Massachusetts, Rhode Island, Maine, Vermont and New Hampshire was obtained through plant site visits, based on lists recieved from state water resources and pollution control departments. The questionnaire used was devised to gather information on existing and future manpower needs in the industry. Data on the number and type of training courses available to the operators was also obtained.

CHAPTER I

An Overview of the New England Situation:

Plants in Operation

Aggregate Employment

Vacancies

Separations

Essential information to any planner revolves around answers to certain basic questions. On the most basic level,"How many plants are in operation?" and "How many people work in these locations?" Once provided with answers to these questions, further analysis calls for answers to two questions; "Are all positions now filled?" and "Is the composition of the labor force stable?".

Information answering these four questions is the basis of chapter one. All data is provided on a state by state basis.

PLANT INFORMATION

Table 1 shows that there are 317 municipal wastewater treatment plants in New England, 56.5% of them being secondary plants. Only Rhode Island and Vermont had more primary plants than secondary plants. Massachusetts had almost twice as many secondary plants as primary ones.

TABLE 1

PLANTS SURVEYED (BY STATE)

State	# of Primary Plants	# of Secondary Plants	Other Plants	Total # Plants	Total # of Full Time Workers
Connecticut	33	47	6	86	707
Maine	14	26	1	41	74
Massachusetts	30	58	1	89	620
New Hampshire	16	18	1	35	85
Rhode Island	8	6	0	14	193
Vermont	27	24	1	52	69
New England (Total)	128	179	10	317	1,748

Job Vacancies

The United States average job vacancy rate was 2.1%*, while the rate for New England was 6%. This difference is partly due to the fact that there has recently been a significant increase in construction of wastewater plants. The state figures ranged from a low of 1% in Vermont and New Hampshire to a high of 9% in Rhode Island and Massachusetts. It is interesting to note that two very densely populated states had the highest rates, while two rather sparsely populated states had the lowest rates.

Although the New England vacancy rate might appear relatively high, this may be misleading since more than half of the vacancies are from only 3 plants. Deer Island and Nut Island (Massachusetts) have 37 and 14 respectively while Hartford, Connecticut has 15. If one adjusts the rates excluding these three plants, the vacancy rate for New England would come more in line with the United States average.

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*Preliminary Survey - "Municipal Wastewater Facilities." United States Department of Labor, 1971.

TABLE 2

VACANCIES IN NEW ENGLAND

State	# Vacancies	Vacancy Rate*
Connecticut	24	3%
Maine	4	5%
Massachusetts	60	9%
New Hampshire	1	1%
Rhode Island	20	9%
New England (Total)	110	6%

---

*The statistic was: $\frac{\#\text{ Vacancies}}{\text{Total }\#\text{ employed }+\ \#\text{ vacancies}}$

Separations

In New England there was a total of 191 separations. Vermont had the highest turnover rate with 16%, while Connecticut had the lowest turnover rate at 7%.* These rates should be compared to the average turnover rate of wastewater facilities in the United States which is 10.4%.** It appeared that the vast majority of separations was due to workers quitting. High turnover rates are a matter of concern since persistent separations increase training costs and lowers the average amount of experience in the industry. The table below lists the separations by state with the turnover rates.

TABLE 3

SEPARATIONS

State	# of Separations	Turnover Rate
Connecticut	56	7%
Maine	11	15%
Massachusetts	79	13%
New Hampshire	13	15%
Rhode Island	21	10%
Vermont	11	16%
Total	191	

---

*Turnover rate is equal to the $\frac{\text{\# of separations}}{\text{total employment}}$
The average turnover rate for the U.S. is 10.4%

**Preliminary Survey - "Municipal Wastewater Facilities", U. S. Department of Labor, 1971.

CHAPTER II

LABOR FORCE CHARACTERISTICS

Chapter two provides detailed information on the characteristics of the labor force. Information is provided both by occupation and by state.

Aggregate Employment Data

Below are data for the "Current" and "Recommended" Full Time categories, each based on the same sample. Recommended totals are total staffing levels proposed by engineer at time of construction. Some older plants are excluded from the tabulation because data on recommended staffing is either no longer available or pertinent.

TABLE 4A

CURRENT AND RECOMMENDED MANPOWER TOTALS

State	(1) Current Full Time	(2) Recommended Full Time	(3) Percentage of Current Personnel in Excess of Recommended Totals*
Connecticut	271	262	+ 3.3%
Maine	63	48	+23.8%
Massachusetts	265	245	+ 7.5%
New Hampshire	76	44	+42.1%
Rhode Island	158	177	-12.0%
Vermont	67	55	+17.9%
New England (Total)	900	831	+ 7.7%

The apparent anomaly in the Rhode Island figures is due to the fact that one of the large plants is currently incorporating secondary treatment. The plant is not going to operate at "full force" until the construction is finished.

---

*Current Full Time is taken as the base. $\frac{\text{Col. 1 - Col. 2}}{\text{Col. 1}}$ = Col. 3

There is a tendency to have more people working than was recommended by the engineers. The engineering firms do not always make manpower allowances for work such as repair, maintenance, and general care. Yet, in the course of operation, these tasks come up forcing the plant to hire new people. There also may be a tendency on the part of the consultants in their selling attempt to underestimate the real costs that continue after the construction of the plant.

TABLE 4B

CURRENT VS. YEAR AGO FULL TIME MANPOWER TOTALS (EEA INCLUDED)

State	Current Full Time	Year Ago Full Time	Percentage Difference*
Connecticut	707	612	+15.5%
Maine	74	73	+ 1.3%
Massachusetts	620	623	- 0.4%
New Hampshire	85	83	+ 2.4%
Rhode Island	193	191	+ 1.0%
Vermont	69	69	0.0%
New England (Total)	1,748	1,651	+ 5.4%

---

*Year ago Full Time is taken as the base.

The table following shows that the difference between the current work force and the work force one year ago was not great. The current fulltime work force in New England was 5.4 percent larger than the work force one year ago.

TABLE 4C

NEW ENGLAND MANPOWER TOTALS - (ALL OCCUPATIONS)

State	Current Full Time	Current Part Time	Authorized Full Time	Authorized Part Time	Year Ago Full Time	Year Ago Part Time
Connecticut	707	31	664	25	612	93
Maine	74	16	73	16	73	13
Massachusetts	620	21	638	36	623	20
New Hampshire	85	17	82	17	83	17
Rhode Island	193	1	207	1	191	1
Vermont	69	46	68	43	69	48
Totals	1,748	132	1,732	138	1,651	191

Age

The age of the current work force is an important consideration for manpower planning. It can safely be assumed that anyone now in their sixties will be retiring within ten years and even many of those in their fifties will not be working a decade later.

From Table 5A following, it can be seen that there is hardly any variance in mean age by states, and except for the top two positions, there is not much variance by occupations.

The percentage of workers sixty and over is above ten percent in each state, but there is a wide variance by occupation groups. It is important to note that many of the older workers hold the important supervisory and administrative jobs. In the next ten years, between 25 percent and 58 percent of the superintendents will be retiring. The situation of foremen, assistant superintendents, and operations supervisors is not much better.

TABLE 5A

AGE (BY STATE)

State	Mean	Standard Deviation	Maximum	Minimum	% <30	% 50-59	% 60-69
Connecticut	45	14	69	19	20.5	28.6	12.7
Maine	42	13	69	18	17.5	13.7	11.2
Massachusetts	44	12	69	18	19.2	28.5	10.8
New Hampshire	44	12	68	22	33.0	11.0	11.0
Rhode Island	46	12	68	22	13.4	35.8	10.9
Vermont	42	14	67	19	22.9	21.8	12.6

TABLE 5B

AGE (BY OCCUPATION)

Occupation	Mean	Standard Deviation	Maximum	Minimum	% <30	% 50-59	% 60-69
Superintendent*	53	8	68	38	0.0	32.5	25.0
Ass't. Superintendent	52	8	63	34	0.0	50.0	12.5
Operations Supervisor	46	11	69	25	8.6	32.2	13.8
Sole Operator	45	12	67	19	14.1	20.3	9.4
Foreman	50	13	69	22	10.6	38.3	19.1
Operator	42	13	69	18	21.3	26.3	10.1
Skilled Maintenance	46	12	67	22	14.6	33.0	10.7
Laborer	41	14	65	18	31.4	22.3	10.7
Chemist	42	15	67	20	39.0	20.3	16.9

* See Definitions in Appendix B.

Civil Service

Table 6 indicates that the number of men who are civil service employees varies widely from state to state. While there are no civil service employees in Maine and Vermont and only 14.3 percent of all employees interviewed in New Hampshire were under civil service, 67.1 percent of the Massachusetts sample were under civil service regulations.

For a breakdown on the percent of each occupation which is covered by civil service within each state see Table 6.

TABLE 6

PERCENTAGE OF CIVIL SERVICE WORKERS
(By State & Occupation)

Occupation	Conn.	Me.	Mass.	N.H.	R.I.	VT.	All N.E.
Superintendent	40.0	*	77.8	33.3	42.9	0.0	47.5
Assistant Superintendent	0.0	*	100.0	*	50.0	0.0	50.0
Operations Supervisor	24.1	0.0	35.4	14.3	54.5	0.0	22.4
Sole Operator	50.0	0.0	10.5	0.0	*	0.0	7.8
Foreman	26.1	*	90.9	33.3	22.2	0.0	40.4
Operator	37.6	0.0	62.6	3.0	58.7	0.0	42.6
Skilled Maintenance	30.8	0.0	87.5	50.0	43.8	*	64.1
Laborer	44.8	0.0	79.1	31.3	40.7	0.0	55.8
Chemist	26.1	*	82.6	33.3	70.0	*	55.9
Other	25.0	*	86.7	0.0	42.9	0.0	67.4
% of Wastewater Employees covered by Civil Service	35.4	0.0	67.1	14.3	52.3	*	*

*No comparably defined job category in these states (See Appendix B for definitions)

Union Membership

The percentage of workers who were union members varied greatly both by occupation and by state. Of all wastewater plant employees in Rhode Island, 92% were affiliated with a union. Maine and Vermont represented the other extreme, having only 7% and 11% respectively, of their labor force unionized.

Union membership by occupation also varied widely. Sixty-six percent of all mechanics were union members. Only 9% of sole operators had any such affiliation. One point to be gained from Table 7B is the fact that union members are more likely to be found in larger plants, while workers at the smaller plants are less likely to be unionized. Sole operators is a job category exclusively relating to small plants. Mechanics, on the other hand, along with the majority of operators and laborers were found in larger plants serving areas of greater size and population.

TABLE 7A

EXTENT OF UNION MEMBERSHIP IN THE WASTEWATER INDUSTRY
(By State)

State	Percentage of Work Force Who Are Union Members
Connecticut	57
Maine	7
Massachusetts	43
New Hampshire	19
Rhode Island	92
Vermont	11
Total (Six States)	49

TABLE 7B

EXTENT OF UNION MEMBERSHIP IN THE WASTEWATER INDUSTRY
(By Occupation)

Occupation	% of Occupation Class Unionized
Superintendent	14
Assistant Superintendent	14
Operations Supervisor	22
Sole Operator	9*
Foreman	46
Operator	55
Mechanics	66
Laborers	62
Chemists	40

*Small plant-Small town-No union.

EMERGENCY EMPLOYMENT ACT

The Emergency Employment Act (EEA) which created the Public Employment Program (PEP) was designed to make federal financial assistance available to public officials. These funds would be used to employ underemployed or unemployed persons with transitional jobs in the public sector in localities experiencing high unemployment rates. Many unemployed or underemployed persons have thus been employed in the wastewater industry under EEA provisions. EEA personnel were mostly employed at the level of laborers or operators. Some states have relied heavily on EEA employees to operate the plants. In Vermont, 11.5% of all employees were funded through the EEA, while in New Hampshire only 6.6% of the working force were funded through the EEA. It must be emphasized that the PEP was designed as a temporary aid. If the funds run out either for political or economic reasons, those municipalities that rely heavily on EEA personnel will be greatly hurt. For instance, Vermont could lose 23% of its operators unless the Vermont municipalities expand their budgets for wastewater facilities. Below is a detailed Table with the percentage of all EEA personnel listed by state and by occupation.

TABLE 8

PERCENTAGE OF WASTEWATER EMPLOYEES HIRED UNDER THE EMERGENCY EMPLOYMENT ACT

(By State and Occupation)

Occupation	Conn.	Me.	Mass.	N.H.	R.I.	VT.	N.E.
Superintendent	0.0	*	11.1	0.0	0.0	0.0	2.5
Assistant Superintendent	0.0	*	0.0	0.0	0.0	0.0	0.0
Operations Supervisor	0.0	0.0	0.0	0.0	0.0	4.2	0.6
Sole Operator	0.0	10.0	5.3	0.0	0.0	0.0	3.1
Foreman	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operator	8.5	15.0	9.3	12.1	9.6	23.1	10.3
Skilled Maintenance	7.7	0.0	1.8	0.0	6.2	0.0	3.9
Laborer	19.0	13.2	17.4	12.5	7.4	0.0	15.2
Chemist	13.0	*	13.0		0.0	0.0	10.2
Other	0.0	*	3.3	0.0	14.3	0.0	0.0
All occupations (Total)	8.2	8.7	8.4	6.6	7.3	11.5	8.3

* No comparably defined job category in these states (See Appendix B for definitions).

EDUCATION

On the average, those individuals employed in the wastewater industry had eleven years of formal education. As shown by Table 9A presented below, the educational attainment didn't vary significantly between states. As might be expected, as responsibility at the plant increased, whether in manual or administrative work, so did the number of years of school completed.

TABLE 9A

YEARS OF SCHOOL COMPLETED (BY STATE)

State	Mean	Standard Deviation	Maximum	Minimum
Connecticut	11.30	0.16	17	5
Maine	11.47	1.87	15	6
Massachusetts	11.67	1.99	22	4
New Hampshire	11.54	2.27	21	6
Rhode Island	11.25	1.74	16	7
Vermont	11.12	1.64	13	7

TABLE 9B

YEARS OF SCHOOL COMPLETED (BY OCCUPATION)

Occupation	Mean	Standard Deviation	Maximum	Minimum
Superintendent	13.12	2.26	18	7
Assistant Superintendent	13.14	2.53	16	8
Operations Supervisor	12.05	1.64	17	7
Sole Operator	11.30	1.77	14	7
Foreman	11.20	1.61	14	8
Operator	11.08	1.94	16	5
Mechanic	11.69	2.82	16	6
Laborer	10.50	2.08	16	5
Chemist	14.60	2.73	22	9

LENGTH OF SERVICE IN THE WASTEWATER INDUSTRY

For the most part, it was observed that in order to "climb the ladder" of occupational categories in the wastewater industry, an accumulation of experience is necessary. This can be observed in the table below which shows laborers having the least number of years of experience and superintendents the most. If the ladder is depicted by including the following five categories, the theory holds:

Category	Mean Years
Laborers	4.9
Operators	6.4
Operations Supervisor	10.2
Assistant Superintendent	14.6
Superintendent	15.5

This might be somewhat expected in light of the certification programs and the requirements for certain occupational categories in terms of experience.

A comparison of the average length in the wastewater industry for all occupations by state, yields rather striking differences. Rhode Island, for instance, has a mean length of 7.87 years which is almost twice that of Maine's 4.07 mean. Such data might indicate that the plants, whose employees have more years in the industry have probably been in operation for longer periods of time. This also holds with Rhode Island, Massachusetts and Connecticut having generally older plants than New Hampshire, Vermont, and Maine.

One conclusion to be avoided is that those states whose average working experience is higher, necessarily have better qualified individuals operating those plants. The qualifications of various operators depends on more factors than just time within the industry. Examples of such variables might be training in wastewater treatment, education, previous experience, etc.

TABLE 10A

LENGTH OF SERVICE IN WASTEWATER INDUSTRY (BY STATE)

State	Mean	Standard Deviation	Maximum	Minimum
Connecticut	7.24	8.21	35	0
Maine	4.07	3.96	23	0
Massachusetts	7.72	8.25	37	0
New Hampshire	5.72	7.34	35	0
Rhode Island	7.87	7.06	31	0
Vermont	5.01	5.60	37	1

TABLE 10B

LENGTH OF SERVICE IN WASTEWATER INDUSTRY (BY OCCUPATION)

Occupation	Mean	Standard Deviation	Maximum	Minimum
Superintendent	15.5	9.1	35	1
Assistant Superintendent	14.5	7.8	25	2
Operations Supervisor	10.2	8.1	37	1
Sole Operator	5.5	5.4	22	0
Foreman	11.4	8.5	36	0
Operator	6.4	7.5	37	0
Mechanic	7.7	6.6	27	0
Laborer	4.9	5.9	35	0
Chemist	6.2	8.2	32	0

TRAINING

The need for qualified wastewater treatment operators is increasing annually with the completion of new complex treatment facilities and a growing public concern over the potential hazard of improper wastewater treatment. The efficiency of a treatment plant is not only a function of the type of facility, but also of the qualifications of the operators. Mandatory certification in many states of persons operating wastewater treatment facilities requires by law well trained operators. Thus the need for training courses has been given increased attention by state and Federal officials. Existing programs are designed to upgrade skills of operators in the field, provide specialized advanced courses for operators, and provide needed training for entry level personnel. Throughout New England long range planning of training courses has not been undertaken. Training courses are planned on a year to year basis, the number and content of the courses being a response from the previous year's experience. The state planning officers all acknowledged the lack of funds and adequate staffing at their level as a constraint in improving existing programs. Another problem which many workers cited, especially in Connecticut, was that only a limited number of people could attend courses from each plant. In the larger plants, this could become a problem when workers who need and desire training courses are restricted due to this practice.

A summary of formal training courses in wastewater treatment offered during the past fiscal year (1971-72) is listed below. Many of the New England states alternate the courses offered from year to year, thus the list does not represent a complete inventory of all the different types of courses that have been available in New England.

The Environmental Protection Agency sponsored a correspondence course which covered nearly all areas in wastewater treatment. In many instances the correspondence course was accompanied by weekly or bi-weekly instruction groups. The number of hours needed to sucessfully complete the course ranged from 50 to 150, depending upon the length of outside instruction supplementing the course material. In New England, 266 people were enrolled in the course during 1971-72. The state-by-state breakdown was Rhode Island - 11; Connecticut - 60; Massachusetts - 64; New Hampshire - 63; Vermont - 27; and Maine 41 enrollees.

The New England Interstate Water Pollution Control Commission (N.E.I.W.P.C.C) offers a nine month (approximately 1,400 hours) course covering all areas of wastewater treatment. The course is offered in South Portland, Maine at the New England Regional Wastewater Institute. During the 1971-72 fiscal year, 27 students attended the institute.

The N.E.I.W.P.C.C. operated a mobile training van which has visited five states in 1972. Examples of training visits are as follows:

1) Berkshire Community College, Pittsfield, Massachusetts
    18 hours of lab   6 students
2) Montpelier, Burlington, and Shelborne, Vermont
    18 hours of lab   20 students
3) Hartford, New Haven, and Ansonia, Connecticut
    21 hours of lab   20 students
4) Leominster, Massachusetts
    21 hours of lab   10 students
5) Bangor, Maine
    21 hours of lab   6 students
6) Holyoke, Essex Aggie College, Massachusetts
7) Springfield, Vermont
8) Rutland, Vermont
9) North Woodstock, New Hampshire

Two short courses were also offered by the N.E.I.W.P.C.C. at the Southern Maine Vocational-Technical Institute in South Portland in 1972.

1) Technical Course #1 -- Applied Wastewater Chemistry
    40 hours   35 students
2) Technical Course #2 -- Pumps and Pumping
    40 hours   34 students

State agencies, both public and private, have been more and more involved in training wastewater operators. The list below indicates the courses which the New England states have conducted.

Connecticut

1) Basic Principles of Sewage Treatment, M.D.C.

36 hours 38 students

2) Basic Principles of Sewage Treatment, Waterbury State Technical College

36 hours 50 Students

3) Basic Training Course - Laboratory, Torrington Sewage Treatment Plant

24 hours

4) Basic Mathematics of Wastewater Treatment

12 hours 40 students

5) Wastewater Treatment Plant Operator Training Program State Labor Department, EPA

102 hours 36 Students

Maine

1) Millipore Filter Technique, South Portland*

8 hours

2) Wastewater Treatment Operator, University of Maine at Portland-Gorham*

16 hours

Massachusetts

1) Two courses -- Laboratory Precedures, Merrimack College, North Andover

45 hours 51 students

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*Sponsored by the Maine Wastewater Control Association.

2) Two courses -- Activated Sludge, Merrimack College North Andover

34 students

3) Two courses -- Laboratory Procedures, Bridgewater State College, Bridgewater

45 hours each 27 students

4) Wastewater Treatment Technology, Springfield Technical Community College, Springfield

Associate Degree Program 14 students

5) Laboratory Procedures, Berkshire Community College, Pittsfield

6) Basic Wastewater Treatment, Essex Agricultural and Technical Institute, Danvers

15 students

7) Wastewater Treatment, Stockbridge School (University of Massachusetts), Amherst

8) Wastewater Treatment, Bristol Community College, Fall River

New Hampshire

1) Intermediate Wastewater Treatment, New England College, Henniker

120 hours 20 students

Rhode Island

1) Basic Wastewater Treatment, Rhode Island Vocational-Technical Institute

80 hours

Vermont

1) Basic Wastewater Treatment Course, Norwich University, Northfield
   30 hours   41 students

2) Basic Wastewater Treatment Course, Springfield High School, Springfield
   30 hours   64 students

3) Laboratory Procedures, Spaulding High School, Barre
   30 hours

4) Laboratory Procedures, University of Vermont, Burlington
   30 hours

5) Flow Recording and Chlorination
   8 hours

6) Laboratory Procedures, Springfield
   24 hours

In the study we measured and compared the extent of training of the personnel in sewage treatment by occupations and by states. The extent of training is not a measure of the quality of wastewater personnel, but is an indication of the quantitative number of courses and duration of formal training undergone by wastewater facility operators in specific fields in wastewater treatment.

The scale employed was:

0 -- No Training - no courses of any type
1 -- Basic Training - 1 to 2 short courses or equivalent (up to 80 hours of instruction)

2 -- Medium Training - 3 to 6 short courses or equivalent (up to 240 hours of instruction)

3 -- Advanced Training - 7 to 20 short courses (up to 800 hours of instruction)

4 -- Extensive Training - one full academic year or equivalent (up to approximately 1,400 hours of instruction)

Out of 1,453 respondents answering questions concerning training 750 (or 51%) people had no training. Operations supervisors had, as a group, the most training with an average level of 1.90. Those personnel with the lowest level were, as expected, laborers who had on the average a .19 level of extent of training. Vermont had the highest level of training with 1.40 and Rhode Island the lowest at .46. This result is interesting considering that neither Rhode Island nor Vermont, as yet, has mandatory certification programs, yet the latter state had the highest and the former the lowest level of training. These cursory results must be viewed carefully, since a state which has a large proportion of laborers or EEA men (who usually have taken fewer courses) might be biased downward. Due to the wide range in hours in each category, one must realize that particular levels of extent of training are merely indications, rather than exact levels. For a more detailed analysis, refer to the tables following.

TABLE 11A

EXTENT OF TRAINING (BY STATE)

State	Mean	Standard Deviation	Maximum	Minimum
Connecticut	0.73	0.90	4	0
Maine	1.20	1.10	4	0
Massachusetts	0.64	0.67	3	0
New Hampshire	1.38	1.04	4	0
Rhode Island	0.46	1.36	4	0
Vermont	1.40	0.97	4	0

TABLE 11B

EXTENT OF TRAINING (BY OCCUPATION)

Occupation	Mean	Standard Deviation	Maximum	Minimum
Superintendent	1.78	1.25	4	0
Assistant Superintendent	1.50	1.00	3	0
Operations Supervisor	1.90	1.05	4	0
Sole Operator	1.42	1.05	4	0
Foreman	1.08	1.22	4	0
Operator	0.88	1.14	4	0
Skilled Maintenance	0.42	0.62	3	0
Laborer	0.19	0.45	3	0
Chemist	0.86	1.12	4	0

TABLE 11C

EXTENT OF TRAINING FREQUENCY DISTRIBUTION

(Percent by Occupation)

Occupation	Level 0	Level 1	Level 2	Level 3	Level 4	Total
Superintendent	23%	20%	28%	23%	6%	100%
Assistant Superintendent	25%	12%	50%	13%	---	100%
Operation Supervisor	8%	28%	40%	16%	8%	100%
Sole Operator	20%	48%	23%	3%	6%	100%
Foreman	49%	27%	11%	4%	9%	100%
Operator	56%	29%	8%	5%	2%	100%
Skilled Maintenance	65%	30%	4%	1%	---	100%
Laborer	84%	14%	1%	1%	---	100%
Chemist	51%	28%	13%	3%	5%	100%

TABLE 11D

EXTENT OF TRAINING FREQUENCY DISTRIBUTION*

(By Occupation)

Occupation	Level 0	Level 1	Level 2	Level 3	Level 4	Total
Superintendent	9	8	11	9	3	40
Assistant Superintendent	2	1	4	1	0	8
Operations Supervisor	15	49	69	28	13	174
Sole Operator	13	30	15	2	4	64
Foreman	22	14	5	2	4	47
Operator	391	212	62	33	14	712
Skilled Maintenance	67	31	4	1	0	103
Laborers	165	29	2	1	0	197
Chemist	25	14	15	2	3	59
Other	37	4	5	0	1	47

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*Number of personnel at each level.

CERTIFICATION PROGRAMS

The licensing of operators within the wastewater industry is for the most part a rather recent occurrence.* It was originally introduced some 15 years ago by the New England Water Pollution Control Association (NEWPCA) in the form of a voluntary program. However, because of its voluntary nature, it failed to reach a majority of eligible plant operators. To remedy this situation various states incorporated the idea with the modification of requiring mandatory certification. Below, in summary form, is a description of the various certification programs. The NEWPCA program is described first, followed by the individual states and their respective qualifications.**

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*Reference is made to the New England Region only. For instance, New Jersey has had a certification for fifty years.

**See Appendix C for information about complete text of each state's regulations.

TABLE 12

SUMMARY OF CERTIFICATION PROGRAMS

Organization or State	Effective Date	Objectives	Certification
NEWPCA		to promote employment of trained, experienced, reliable and efficient personnel for the operation of public and industrial wastewater works.	Requires an application containing educational and experience background which must be submitted to determine whether requirements for specific grades are possible. If so, examinations may be scheduled.
Connecticut	2/11/69	Same as above.	Same as above.
Maine	10/1/70	Same as above.	Same as above.
Massachusetts	7/1/72	Same as above.	Same as above.
New Hampshire	1/1/73	Same as above.	Same as above.
Rhode Island		Legislation on Certification still pending.	
Vermont		Mandatory certification to become effective Jan. 1, 1973.	

TABLE 12 Cont'd

SUMMARY OF CERTIFICATION PROGRAM

Organization or State	Effective Date	Examinations	Re-Examinations	Waivers
NEWPCA		Consists of written and oral parts that should properly reflect the knowledge of the applicant.	Possible in the event of failure, after one year; or application for certification in lower grade is possible at any time.	Certification Committee may at its discretion waive examinations for applicants holding certificates or licenses issued by other states or associations having equivalent standards as determined by the certification committee.
Connecticut	2/11/69	All examinations are of a written format.	Same as above except waiting period is 6 months.	Same as above. Also includes a "Grandfather clause" Sec. 25-26-10g.
Maine	10/1/70	Consists of written and oral parts to reflect knowledge of applicant.	Same as above with waiting period of at least 6 months.	Same as above. Also includes a "Grandfather clause" Sec. 4177

TABLE 12 CONT'D.

SUMMARY OF CERTIFICATION PROGRAM

Organization or State	Effective Date	Examinations	Re-Examination	Waiver
Massachusetts	7/1/72	All examinations are of a written format.	Possible but not more than twice a year after failing the previous examination.	Same as above. Also includes a "Grandfather clause" renewed on an annual basis Sec. IV (f).
New Hampshire	1/1/73	Consists of written and oral parts to reflect knowledge of applicant.	May be repeated at subsequently scheduled examinations.	Same as above. Also includes a two (2) year "Grandfather clause". After such a period, all examinations must be passed.
Rhode Island		Legislation on Certification still pending.		
Vermont		Mandatory Certification to become effective January 1, 1973.		

Due to specific time and experience requirements of various positions, certain vacancies have been difficult to fill. For example, the following is a New Hampshire requirement for becoming a Grade II Operator: "Applicants for this . . . shall submit satisfactory evidence of at least four years experience in responsible charge of a plant in Grade I or higher; or four years successful work experience in operation of a plant in Grade II or higher." The solution to this was simply an "Operator in Training" clause (incorporated by New Hampshire and Connecticut) which waives experience requirements.

> Prerequisites for examination, and designation as an operator in training are the same as the prerequisites in Grade I, II, & III except that the experience time in wastewater works may be waived.*

Just recently, Connecticut went even further in changing their entire statute to reduce the time in each grade necessary for promotion. At the time of this survey, the exact nature of such changes were not available.

Who Benefits From Licensing?

If we assume that the objectives of the certification program are fulfilled, the benefits to the states and society in general are:

1. Improve the quality of wastewater treatment works operator.

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*Regulation 8 Sec. 7B, p.8.

2. Improve the status of wastewater treatment works operators.
3. Provide a roster of qualified personnel.
4. Provide a means whereby those responsible for employment of wastewater treatment works operating personnel can readily determine the qualifications which are considered desirable in such personnel.

More specifically, the efficiency of plants will be at a maximum once the mandatory certification is implemented. This is because of the assurance that all plants are to be operated by certified operators.

The operators will also receive significant benefits with mandatory certification. As a licensed or certified employee, in any industry, one is more likely to receive a higher wage. When the supply of any commodity is restricted (through licensing or other means) the price or wage it commands will be greater.

There is also a prestige factor that enters the stream of operator's benefits. Qualifying certificates add to the status of the operator and define precisely his responsibility. Certification also enhances the operator's credentials adding to his employment security.

Cost of Licensing

Although there are costs (administrative, staffing, etc.) incurred in the process of licensing, it is presumed that the examination and certificate fees cover all such costs. The following listing of fees is abstracted from the Maine certification program to provide an example.*

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* Sec. 4180 p. 10.

Fees for certification shall not be in excess of the following:

Initial certification with examination	$25
Initial certification without examination	10
Re-examination	25
Reinstatement of certificate	5
Annual Renewal fee	3

Fees from those failing to pass an examination will not be returned.

Another cost of licensing is the tendency for licensing boards, once instituted, to pass laws and regulations which put the interests of its own members ahead of public interest. This has been evident in other certification boards which pass unnecessarily high qualifications limiting the supply of many potentially qualified workers. Of course, the protected certified operators will probably receive higher wages and more job security, but at the expense of society and excluded workers.

We conclude, however, that the social benefits of certification within the wastewater industry , by providing competent operators, far exceed costs incurred from such a program.

Summary

We have seen that at this stage of certification a definite trend is underway. Precipitated by the NEWPCA voluntary program, each state is following with an almost identical mandatory one. The states, however, because of various bottlenecks are lagging in their respective certification regulations. The members of this research team express hope that these bottlenecks are eliminated shortly so that the entire New England Region may realize the previously stated benefits from mandatory certification.

At the present time in New England, 27% of the personnel had some form of certification, either the voluntary New England Water Pollution Control Association's or the State's mandatory certification.* Maine which has mandatory certification, has the highest proportion of certified workers (63%) and Rhode Island the lowest (25%). In New England operations supervisors and assistant superintendents had the highest proportion of certification with 72% and 75% respectively. Twenty-eight percent of all operators in New England were certified.

Listed below are state and occupation certification tables. One must be careful about making generalizations about the state tables due to the possibility of states not all having a uniform distribution of job categories.

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* It must be noted that not all workers employed at at wastewater facility must be certified, e.g. chemists, laborers, and skilled maintenance men.

TABLE 13A

CERTIFIED WASTEWATER WORKERS (BY STATE)

State	Percentage of Certified Personnel
Connecticut	32
Maine	63
Massachusetts	43
New Hampshire	22
Rhode Island	25
Vermont	32

TABLE 13B

CERTIFIED WASTEWATER WORKERS (BY OCCUPATION)

Occupation	Percentage of Certified Personnel
Superintendent	65
Assistant Superintendent	75
Operations Supervisor	72
Sole Operator	39
Foreman	40
Operator	28
Skilled Maintenance	5
Laborer	3
Chemist	22

TABLE 13C

CERTIFIED WASTEWATER WORKERS

(By State and Occupation)

Occupation	Conn.	Maine	Mass.	N.H.	R.I.	VT.	All New England
Superintendent	85	---	22	67	71	0	245
Assistant Superintendent	100	---	100	---	50	0	250
Operations Supervisor	85	96	60	57	73	54	425
Sole Operator	33	60	32	23	---	38	186
Foreman	56	---	18	0	44	0	118
Operator	25	58	18	15	24	23	163
Skilled Maintenance	9	0	3	25	13	---	50
Laborer	3	0	2	0	11	0	16
Chemist	39	---	4	33	20	---	96
Other	---	---	---	---	---	---	0

It was felt that a worker's education, extent of training, and length in the industry might influence whether or not he was certified. Therefore, using multivariate regression analysis, we tried to find out just how much of the variation in certification could be explained by the amount of education a person had, the extent of training courses in wastewater treatment a person has had, and by the length of time that a person has been in the industry. We found no significant correlation between education and certification. Only in the cases of Maine and Connecticut was the length in the industry significant. The longer one was in the industry, the more likely he would be certified in Maine and Connecticut. Both states have mandatory certification. The most important variable was the extent of training a worker had undergone. Just as one would expect, the more courses one attended, the more likely he would be certified.

Listed below are tables which list the results of the regression annalyses by occupation and state.* The R^2, in the second column, indicates how much of the variation in certification is being explained by the variables used. If the R^2 is .50 then we can assume that our variables explain 50% of the observed variation in certification, while the other 50% are explained by variables not incorporated in the analysis. The third column lists the significant variables (at a 10% significance level), in order of importance.

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*For the regression equations throughout the report, the corresponding t's and Beta's are found in appendix D.

TABLE 13D

REGRESSION ANALYSIS OF CERTIFICATION

(By State)

State	R^2	Significant Variables
Connecticut	.44	Extent of training Length in Industry
Maine	.38	Extent of training Length in Industry
Massachusetts	.27	Extent of training.
New Hampshire	.16	Extent of training.
Rhode Island	.62	Extent of training.
Vermont	.20	Extent of training.

TABLE 13E

REGRESSION ANALYSIS OF CERTIFICATION

(By Occupation)

Occupation	R^2	Significant Variable
Superintendent	.17	Extent of training.
Operations Supervisor	.14	Extent of training.
Sole Operator	.23	Extent of training.
Operators	.33	Extent of training.

WEEKLY EARNINGS

By Occupation - All states

As might be expected, weekly earnings showed great variation when comparing average salaries of each occupation (see Table 14B). Of the larger occupation groups, laborers were lowest with an average weekly salary of $125, while superintendents showed a mean of $254 per week.

One interesting point is the wide range of salaries that exists between so many of the occupational categories. Take for instance, the $200 and $196 ranges that exist for operations supervisors and foremen respectively. We cite these examples because the two occupations mentioned above are two of the more consistent classifications in our study. By contrast, the wide variation found for chemists is to be expected. This is so because this classification included the chief chemist at Deer Island, as well as the lab technician at Merrimack, N.H.

One might notice that sole operators actually received the lowest average salary. This is indicative of the size of the plant and consequently the municipality. Thus, in trying to explain the great variation that existed, one important variable to be considered is the municipality paying that wage. This will be discussed in greater detail below.

By State - all occupations

Comparisons of mean weekly earnings yields no surprises (see Table 14A). The more populous, relatively urban states

(Massachusetts, Connecticut) had somewhat higher earnings than New Hampshire and Rhode Island, and significantly higher earnings than the less populous rural states--Vermont and Maine. One might also observe that the maximum salaries in those rural states are less than half those of the more urban states.

To a large extent, this is a result of the regional districts in Massachusetts and Connecticut that have greater resources and therefore the ability to pay on such high scales. However, to a certain degree, with the cost of living in these metropolitan areas significantly higher, real income differences may not be as great.

TABLE 14A

WEEKLY EARNINGS (BY STATE)

State	Mean	Standard Deviation	Maximum	Minimum
Connecticut	164	51.05	390	96
Maine	124	34.73	200	65
Massachusetts	156	42.26	420	65
New Hampshire	147	34.91	247	75
Rhode Island	147	29.99	288	96
Vermont	125	42.66	192	75

TABLE 14B

WEEKLY EARNINGS (BY OCCUPATION)

Occupation	Mean	Standard Deviation	Maximum	Minimum
Superintendent	254	62.88	420	175
Assistant Superintendent	229	55.76	350	162
Operations Supervisor	181	71.97	310	110
Sole Operator	115	45.29	198	35*
Foreman	179	24.72	235	139
Operator	144	32.73	273	19*
Mechanics	165	87.92	240	115
Laborers	125	23.49	192	75
Chemists	162	42.89	278	90

* Represents part-time employees.

Regression analysis was performed to identify those factors most responsible for variations in salary levels. The independent variables were years of education, extent of training, certification, unionization, and length in the industry.

The table presented below gives the major findings.

TABLE 14C

REGRESSION ANALYSIS OF WEEKLY EARNINGS

Occupation	R^2 *	Significant Variables
Superintendent	.52	1. Education. 2. Length in industry.
Assistant Superintendent	.97	1. Length in industry. 2. Extent of training. 3. Certification.
Operations Supervisor	.03	Low R^2 yielded no significant variables.
Sole Operator	.06	Low R^2 yielded no significant variables.
Foreman	.45	1. Extent of training.
Operator	.20	1. Extent of training. 2. Unionization. 3. Length in industry.
Skilled Maintenance	.02	Low R^2 yielded no significant variables.
Laborers	.12	1. Length in industry.
Chemists	.31	1. Length in industry. 2. Education.

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*An F-test on each classification was performed and found to be significant at the .01 level, except for skilled maintenance, operations supervisors, and sole operators.

The next striking fact presented in the above table is the fact that in only one instance, the case of assistant superintendents, did the independent variables used explain any more than about 50% of the variation in salary levels. In short, salaries depend on other things which were not, and perhaps could not have been, quantified in our study. Such things as local labor market conditions, municipal allocation for treatment plant operation, as well as varying complexity of job tasks, are likely to affect the rate of remuneration, even though translating such characteristics into a form suitable for regression analysis is, at best, a precarious matter.

Nevertheless, certain points of interest did arise out of this effort. For example, education was a significant factor only in the case of superintendent and chemists. Given the administrative tasks of the one, and the specialized training needed of the other, it is easy to understand why education is an important determinant.

Other, what might be called responsible positions, in the plants are those of assistant superintendent and foreman. In each case the extent of training proved to be important. The fact that these individuals must deal more directly with the men running the machinery, can be cited as a reason that greater training is necessary.

Given the fact that sole operators work in plants in small communities, their earnings are more directly related to the amount of money the management is willing to spend for plant operation and prevailing local wage rates and not to the variables utilized in our equations.

Moonlighting

As Table 15 indicates a substantial number of the workers covered in this study hold a second job. In New England, 13.4 percent of all wastewater personnel hold a second job. Moonlighting ranges from a high of 23.6 percent in Maine to a low of 8.8 percent in Rhode Island.

When moonlighting is broken down by occupation, we find that the highest rate of moonlighting occurs among sole operators, operators, and skilled maintenance men. It is interesting to note that only in Massachusetts is there any moonlighting among chemists. In virtually every state, moonlighting was lowest among chemists, superintendents, and assistant superintendents. At the same time moonlighting averaged 11 percent among laborers, foremen, and other categories.

TABLE 15

PERCENTAGE OF WORKERS WHO HOLD A SECOND JOB

(By state and occupation)

Occupation	Conn.	Maine	Mass.	N.H.	R.I.	Vt.	New England
Superintendent	5.0	---	0.0	0.0	0.0	0.0	2.5
Assistant Superintendent	0.0	---	0.0	---	0.0	0.0	0.0
Operations Supervisor	9.3	21.7	16.6	14.2	0.0	16.7	13.8
Sole Operator	0.0	20.0	26.4	46.2	---	18.8	27.1
Foreman	8.6	---	0.0	0.0	33.3	0.0	10.7
Operator	14.7	25.0	15.0	18.2	9.6	7.7	14.2
Skilled Maintenance	23.0	0.0	16.2	25.0	12.5	---	16.4
Laborer	1.7	33.4	15.1	18.7	7.4	0.0	11.1
Chemist	0.0	---	13.0	0.0	0.0	---	5.1
Other	0.0	---	10.0	0.0	0.0	---	10.9
All Occupations	11.4	23.6	14.6	20.9	8.8	11.5	13.4

Worked in Other Plants

From Table 16 we see that less than 8 percent of the current workers in New England wastewater facilities worked in other such plants at some earlier time. This indicates that there is little mobility from plant to plant in New England.

Among the states, the percentages of the total work force in that state ranged from nearly 10 percent to less than one percent. Rhode Island and Vermont had very low percentages (under one percent and under three percent respectively).

The generally low mobility throughout New England is an indication of the strong tendency to hire workers from within the municipality. Any future training programs in wastewater treatment must be undertaken with this situation in mind, unless the situation can be changed.

In the future, as licensing requirements become stricter and more universal, municipalities may be forced to look outside of their city or town for fully qualified personnel. This would increase plant to plant mobility.

TABLE 16

PERCENTAGE OF WORKERS PREVIOUSLY EMPLOYED IN OTHER WASTEWATER PLANTS

Occupation	Conn.	Maine	Mass.	N.H.	R.I.	Vt.	All New England
Superintendent	25.0	---	11.1	0.0	0.0	0.0	15.0
Assistant Superintendent	0.0	---	66.7	---	0.0	0.0	25.0
Operations Supervisor	29.6	17.4	20.8	21.4	0.0	0.0	19.0
Sole Operator	16.7	20.0	5.3	7.7	0.0	12.5	10.9
Foreman	8.7	---	9.1	33.3	0.0	0.0	8.5
Operator	5.7	5.0	7.9	6.1	1.0	0.0	5.3
Skilled Maintenance	7.7	0.0	5.4	0.0	0.0	---	4.9
Laborer	3.4	0.0	7.0	0.0	0.0	0.0	4.1
Chemist	8.7	---	13.0	33.3	0.0	---	10.2
Other	0.0	---	16.7	0.0	0.0	0.0	10.9
Total Work Force	9.1	7.5	9.8	8.8	0.5	2.3	7.8

Previous Employment

The most frequent previous employment of the workers interviewed was that of public works. Former town workers were given first notice on job openings in new plants. Many individuals also appeared to have come directly from the military, although seldom having training in the wastewater field. A further breakdown is presented in Table 17. These figures should be kept in mind when trying to locate future sources of labor.

TABLE 17

PREVIOUS OCCUPATIONAL & INDUSTRIAL BACKGROUND OF TREATMENT PLANT WORKERS

BY EMPLOYMENT & STATE

(in number of men)

Industrial Breakdown

Previous Employment	Conn.	Maine	Mass.	N.H.	R.I.	Vt.	All New England
None	23	1	23	6	8	3	64
Military	27	10	51	10	11	9	118
Town Employee	64	17	91	23	18	27	240
Textiles	4	0	11	0	7	2	24
Shoe Manufacturing	0	3	13	4	0	0	20
Railroad	2	0	1	1	1	4	9
Paper Mills	0	0	9	0	0	0	9
Agriculture	3	4	2	2	1	2	14
Construction	23	8	22	4	7	6	70
General Manufacturing	48	2	32	2	8	1	93
Retail Sales	19	1	10	2	4	0	36
Steel Mills	0	2	10	2	0	0	14

Continued

TABLE 17 Cont'd.

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Occupational Breakdown

Previous Employment	Conn.	Maine	Mass.	N.H.	R.I.	Vt.	All New England
Skilled Workers	19	0	30	2	27	2	80
Unskilled Workers	37	50	2	32	0	2	123
Building Construction	13	1	8	1	0	1	24
Plumber	5	0	9	2	4	3	23
White Collar	12	1	19	3	4	2	41
Engineer	2	0	8	2	1	1	14
Mechanic-Machine Shop	37	7	24	8	20	7	103
Other	38	16	46	11	13	14	138
Total							1,257

Promotion

Upward mobility in an industry may be an important consideration to anyone entering it. Table 18B shows that in all but four job categories, nearly one half or more of the men have been promoted to their present jobs.

The reasons why there are few promotions in the other job categories are quite clear. For example, it is not surprising that no one has been promoted to the chemist's position. This is a highly specialized job, and most of the men in that category enter the industry as trained chemists or lab technicians.

Other points of entry into the industry seem to be in the laborer, operator, and sole operator categories. Furthermore, on the average, the men in those three positions have the lowest number of years in the wastewater industry (Table 10B). It will be shown below that the length of time in the industry is an important factor in deciding promotions.

Except for Maine and possibly Vermont, the percentage of promotions does not vary much by state. Once again, this can probably be explained by a lower average number of years in the wastewater industry for those two states. Moreover, both are states characterized by small plants.

TABLE 18A

PROMOTIONS (By State)

State	Mean	Standard Deviation	Maximum*	Minimum
Connecticut	0.36	0.48	1	0
Maine	0.08	0.27	1	0
Massachusetts	0.45	0.53	1	0
New Hampshire	0.48	0.50	1	0
Rhode Island	0.37	0.48	1	0
Vermont	0.21	0.41	1	0

TABLE 18B

PROMOTIONS (By Occupation)

Occupation	Mean	Standard Deviation	Maximum*	Minimum
Superintendent	0.50	0.50	1	0
Assistant Superintendent	0.75	0.43	1	0
Operations Supervisor	0.44	0.50	1	0
Sole Operator	0.19	0.39	1	0
Foreman	0.67	0.47	1	0
Operator	0.36	0.48	1	0
Skilled Maintenance	0.52	0.50	1	0
Laborer	0.14	0.35	1	0
Chemist	0.00	0.00	0	0

*1=Promoted 0= Not promoted. Therefore, the means can easily be converted into the percentage of promotions.

In order to find out more about what factors influenced promotions, 15 regression equations were run--one for each of the six New England states and one for each of the nine occupations categories. Using promotions as the dependent variable and extent of training, certification, grade of certification, and number of years in the wastewater industry as the four independent variables the results, shown below in Tables 18C and D, were obtained.

In the ten regression equations that did prove to be significant, at the highest level R^2 was .36 with most of them hovering around .10. The explanatory variable that does show up the most is in fact the number of years in the wastewater industry. This also seems to be intuitively logical.

It is more difficult to understand the results of the influence of certification. Except for laborers, in those equations where certification was important, it had a negative correlation. Thus, there was less of a tendency to be promoted if one was certified.

The extent of training was important in one occupation (sole operators) and two states (Massachusetts and Rhode Island), while the grade of certification was a factor only in the case of superintendent.

TABLE 18C

REGRESSION ANALYSIS OF PROMOTION (By State)

State	R^2	Significant Variables
Connecticut	.10	Years in wastewater industry
Maine	---	Regression equation not significant
Massachusetts	.19	Certification, training, years.
New Hampshire	---	Regression equation not significant
Rhode Island	.13	Certification, years, training
Vermont	----	Regression equation not significant

TABLE 18D

REGRESSION ANALYSIS OF PROMOTION (By Occupation)

Occupation	R^2	Significant Variables
Superintendent	.24	Grade of certification
Assistant Superintendent	---	Regression equation not significant
Operations Supervisor	.06	Years in wastewater industry
Sole Operator	.36	Years, training, certification
Foreman	---	Regression,equation not significant
Operator	.12	Years in wastewater industry
Skilled Maintenance	.11	Years in wastewater industry
Laborer	.14	Certification, years
Chemist	---	-------------------------

Distance to Work

One factor that should be considered in the expanding wastewater industry is the commuter trends of the labor force. In order to get some idea of how far people would be willing to commute to work at a water pollution control plant, we asked the people now working at the plants how long it usually takes them to get to work. The results, by states and occupations, can be seen in Tables 19A and B below.

Although the means vary from 9 minutes in Rhode Island to 17 minutes in Massachusetts, the percentage of workers who take less than 20 minutes to get to work ranges from 72% to 92%. Furthermore, in Vermont, Maine, and New Hampshire, 64%, 50%, and 44% of the workers live within 5 minutes of the treatment plant.

It seems that in the more rural areas, the workers are predominantly local people. This is because the towns are quite far apart, and even more important because in small rural plants the operators usually work on a 24 hour emergency basis. Thus it is necessary that they live near the plant. Furthermore, on more than one occasion, we were told that only local people would be hired even if a more qualified applicant were available from the neighboring town.

TABLE 19A

DISTANCE TO WORK (In Minutes, By State)

State	Mean	Standard Deviation	Max.	Min.	% <10	% 10-19
Connecticut	11	6	55	2	27	64
Maine	10	11	75	1	50	37
Massachusetts	17	15	99*	2	27	45
New Hampshire	14	3	25	5	44	43
Rhode Island	15	4	35	2	5	87
Vermont	9	6	30	2	64	24

TABLE 19B

DISTANCE TO WORK (In Minutes, By Occupation)

Occupation	Mean	Standard Deviation	Max.	Min.	% <10	% 10-19
Superintendent	13	8	40	5	25	57
Assistant Superintendent	19	16	60	10	0	75
Operations Supervisor	11	11	99*	2	48	41
Sole Operator	8	5	30	1	58	34
Foreman	13	7	45	4	21	66
Operator	12	9	99*	2	30	58
Skilled Maintenance	18	13	75	2	17	51
Laborer	14	8	60	2	16	67
Chemist	17	11	60	5	7	66

*This also includes all responses greater than 99.

CHAPTER III

FIVE YEAR MANPOWER PROJECTION

The projection of future manpower needs in municipal wastewater plants is a necessary prerequisite for quality planning. A five year projection was made throught the examination of six factors.

1. Reduction in the existing labor force due to possible curtailment of Emergency Employment Act Funds.
2. Reduction in the existing labor force due to retirements.
3. Reduction in the labor force because of separations due to quits, deaths, etc.
4. Present vacancies in the existing labor force.
5. Increased future needs due to the construction of new plants.
6. Increased future needs due to additions to existing plants.

Emergency Employment Act (EEA)

As the following table (20A) indicates, 8.3% of the existing wastewater labor force has been hired under EEA funds. If at any time in the next five years this program is eliminated, 120 men throughout New England may be released. If these 120 federal positions are reinstated in the municipal budgets involved there may be 120 vacancies open to the entire New England region (to qualify for the EEA positions one must be unemployed for a certain length of time). This may or may not be a source of improvement in the quality of the present work force, depending on whether or not all of the EEA workers are rehired or whether they are replaced by more highly trained workers.

TABLE 20A

WORKERS UNDER THE EMERGENCY EMPLOYMENT ACT

(By State)*

State	Number of EEA Workers	% of State Work Force Under the EEA
Connecticut	41	8.2
Maine	7	8.7
Massachusetts	42	8.4
New Hampshire	6	6.6
Rhode Island	14	7.3
Vermont	10	11.5
All New England	120	8.3

*Reported in number of men and percent of state workers who were interviewed.

Retirement

We have assumed that anyone who is presently 60 and over will retire in the next five years. On that assumption we can predict that there will be at least 169 retirements in the next five years. The following table (20B) gives a breakdown of men aged 50 to 60 and 60 and over by occupation.

TABLE 20B

AGE OF EXISTING MANPOWER IN NEW ENGLAND

(By Occupation)

Occupation	Total No. of Men	No. of Men 50-60	No. of Men 60 and Over
Superintendent	40	13	10
Assistant Superintendent	8	4	1
Operations Supervisor	174	56	24
Sole Operator	64	13	6
Foreman	47	18	9
Operator	716	187	72
Skilled Maintenance	102	34	11
Laborer	197	44	21
Chemist	59	12	10
Other	46	0	0

If we further assume that one-third of all the men aged 55 to 60 will also retire in the next five years we have an additional 50 retirements.

Separations

In the past year there were a total of 191 separations due to deaths, retirements, firings, and quits. Excluding retirements, which have already been counted, we still have an annual rate of separations of approximately 150 workers. If this rate of separations continues over the next five years there will be in the neighborhood of 750 additional openings due primarily to quits by 1976.

Vacancies

There are currently 110 vacancies.* There is no evidence which leads us to believe that this situation is likely to change very much in the near future. It is true that training programs have increased participation, but relatively low salary levels and poor distribution remain as causative elements of vacancy levels.

New Plants

Current expections, as the following table (20C) illustrates, are that a total of eleven primary plants will be constructed or at least be under construction by 1976. It is estimated** that a total of 41-61 men will be needed to operate these eleven new primary plants.

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* A majority of the vacancies exist in three large plants.

** All estimates were made by extrapolating out of tables 7 through 15 of Estimating Costs and Manpower Requirements For Conventional Wastewater Treatment Facilities, authored by W.L. Patterson for the E.P.A., Oct. 1971, pp. 136-144.

TABLE 20C

MANPOWER PROJECTION FOR NEW PRIMARY PLANTS*

State	Approx. No. of Men Needed	No. of New Plants
Connecticut	0	0
Maine	0	0
Massachusetts	30-40	5
New Hampshire	1-6	3
Rhode Island	10-15	3
Vermont	0	0
Total	41-61	11

In addition to the eleven new primary plants to be constructed by 1976 there are going to be 228 new secondary plants begun or completed by 1976. As the following table (20D) indicates an expected 440-850 men will be needed to run these 228 new secondary plants. For a complete listing of present plants to which additions are planned, new primary, and new secondary plants, as well as projected manpower needs see Table 21.

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* Construction begun by 1/76 if not already completed.

TABLE 20b

MANPOWER PROJECTIONS FOR NEW SECONDARY PLANTS*

State	Approx. No. of Men Needed	No. of New Sec. Plants
Connecticut	90-120	15
Maine	130-270	82
Massachusetts	130-230	51
New Hampshire	40-90	23
Rhode Island	30-40	4
Vermont	20-100	53
Total	440-850	228

Additions

Aside from the construction of new plants there will be considerable expansion of existing plants. It is estimated that 565 to 695 additional men will be needed to operate the 63 plants which will be expanded by 1976. The following table gives a state by state breakdown of the projected manpower needs arising from additions to existing plants.

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* Construction begun by 1/76 if not already completed.

TABLE 20E

MANPOWER PROJECTIONS FOR ADDITIONS TO EXISTING PLANTS*

State	App. No. of Men Needed	No. of Plant Additions
Connecticut	260-290	16
Maine	70-100	14
Massachusetts	120-140	13
New Hampshire	35-50	8
Rhode Island	30-50	4
Vermont	50-65	8
Total	565-695	63

Excluded in all of the calculations for new or expanding plants are a relatively small number of plants for which future MGD and population data were not available, making projection of future manpower needs somewhat less exact. However, the manpower requirement of this small number of plants is not very large when compared to the needs of the entire group.

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* Construction begun by 1/76 if not already completed.

Summary

According to the following table (20F), which is a summary of all of the manpower projection tables, the total demand for wastewater personnel in the next five years will be somewhere between 2,245 and 2,805 workers.

If it is assumed that most EEA workers will be rehired by the plant they currently work at, should EEA funds be out of hand replaced by municipal funds, then the lower limit of men needed by 1976 falls to 2,125 and the upper limit to 2,682. If we assume relatively even growth over the next five years of plants now planned, this would mean about 450 to 560 men needed each year.

TABLE 20F

FIVE YEAR MANPOWER PROJECTIONS*(Based Upon Expected Openings)

Reason For Demand	Conn.	Maine	Mass.	N.H.	R.I.	Vt.	All New England
Elimination of EEA	41	7	42	6	14	10	120
Retirement of men over 60 now	64	9	54	10	21	11	169
Retirement of 1/3 men 55-60 now	23	---	21	1	---	---	50
Separations other than retirement							750
Vacancies now existing	24	4	60	1	20	1	110
To staff new secondary plants	90-120	130-170	130-230	40-90	30-40	20-100	440-850
To staff new primary plants	0	0	30-40	1-6	10-15	0	41-61
To staff expanded plants	260-290	70-100	120-140	35-50	30-50	50-65	565-695
Total							2,245-2,805

* Projections based only on plants where future MGD or future population were available

TABLE 21

1977 MANPOWER PROJECTIONS

Connecticut Five Year List

Municipality	Type of * Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Bridgeport East Side	47	44.0	14.000	12/72	-----
Bridgeport West Side	47	18.0	30.000	10/72	-----
Colchester	37		1.000	12/73	6-8
Coventry	37		5.700	1/75	12-14
Deep River	37		.100	10/72	0-2
Derby	47	2.10	3.000	74	-----
East Hampton (Center)	37		1.800	3/74	7-9
East Hartford (MDC)	47		6.000	5/73	-----
Enfield	47	1.50	10.000	9/72	-----
Glastonburg (East)	37		.010	6/73	0-1
Groton (town)	37		5.000	12/72	12-14
Guilford	37		1.240	74	6-8
Killingly	47	1.50	8.000	12/74	-----

* Explanation of Plant Codes found at end of state lists.

Connecticut Five Year List Cont'd.

Municipality	Type of Plant Needed	Present MGD Cap.	Future MDG Cap.	Proj. Date of Comp.	Manpower Needed
Middletown (Conn. River)	47	3.00	10.20	12/73	-----
Montville	37		3.00	10/74	9-11
Naugatuck	47	1.50	10.50	8/73	-----
New Haven (Blvd)	47	14.00	63.00	8/76	-----
New Haven (East Shore)	47	12.00	34.40	3/76	-----
New London(Trumbull)	47	1.50	12.04	6/74	-----
New Milford	37	.50	4.62	12/75	3-5
Newton (town)	37		1.80	1/74	7-9
Norwalk	47	30.00	15.00	12/73	-----
Norwich	47	4.50	8.50	3/74	-----
Ridgefield	47		.72	12/73	-----
Rocky Hill	47	2.50	7.50	3/73	-----
Simsbury	37		1.80	1/74	7-9

Connecticut Five Year List Cont'd

Municipality	Type of Plant Needed	Present MGD Cap.	Future MDG Cap.	Proj. Date of Comp.	Manpower Needed
Somers	37		1.40	5/74	7-9
Stafford	49		2.00	5/72	-----
Stamford	47	10.00	20.00	12/74	-----
Stonington	37		.66	6/74	4-6
Stonington (Pawcatuck)	37		1.10	6/74	6-8
Stratford	47	4.50	13.00	6/73	-----
Suffield	47	1.00	1.40	12/74	-----
Thompson	37		1.36	9/72	7-9
Vernon	49	3.50	3.50	12/74	-----
Waterbury	47	30.00	20.00	8/73	-----
West Haven	47	16.00	12.70	6/73	-----
Windham	47	2.20	5.50	4/73	-----
Windsor Locks	47	1.30	1.61	12/74	-----
				TOTAL	93-122*

*Totals do not include categories on previous charts (i.e. EEA, retirements, and separations).

Maine Five Year List

Municipality	Type of * Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Augusta	47	6.0	6.8	10/76	-----
BaileyVille	37		(2000)**	(2)12/72	1-3
Bangor	47		9.0	10/76	-----
Bar Harbor	37		(3805)	10/76	2-4
Belfast	37		(4500)	10/76	2-4
Berwick	37		(61,200)	10/76	12-14
Bethel	37		(1200)	10/76	0-2
Biddeford Pool	37		(2000)	10/76	1-3
Blue Hill	37		(500)	10/76	0-1
Booth Bay Harbor	47	1.0	.643	10/75	-----
Brewer	37		(8400)	10/76	6-8 1 yr.
Bridgton	39		(600)	-----	-----
Brownville Junction			(800)	-----	-----

* Explanation of Plant Codes found at end of state lists.

**Figures in ( ) indicate future sewered population not MGD.

Maine Five Year List Cont'd

Municipality	Type of Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Brunswick	47	2.5	2.5	10/76	-----
Bucksport	37	(1000)	(1000)	10/76	0-2
Canton	37		(100)	11/73	0-1
Caribou	47		2.0	10/75	-----
Castine	37		(1200)	10/76	0-2
Clinton	37		.20	10/76	1-3
Damariscotta	37		(400)	-----	0-1
DanFord	37		(200)	-----	0-1
Dexter	37		(2500)	10/72	1-3
Dixfield	37		(1200)	10/76	0-2
Dover-Foxcroft	37		(2500)	10/76	1-3
East Millirocket	37		(2500)	10/76	1-3
East Port	37		(2500)	10/76	1-3
Ellsworth	37		(4000)	10/76	2-4

Maine Five Year List Cont'd.

Municipality	Type of Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Farmingdale	37		(3900)	10/74	2-4
Fort Fairfield	37		(3500)	10/76	2-4
Freeport	47	.23	(1460)	10/75	-----
South Freeport	37		-----	10/75	-----
Gardiner	37		(4500)	10/76	2-4
Gorham	37		(300)	10/76	0-1
Greenville	37		-----	10/74	-----
Guileford	37		(1200)	10/76	0-2
Hartland	37		(1050)	10/76	0-2
Houlton	37		(7000)	10/71	4-6
Howland	37		(1315)	10/76	0-2
Island Falls	37		(800)	10/74	0-1
Isleboro	37		-----	10/76	-----

Maine Five Year List Cont'd.

Municipality	Type of Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Jackman	37		(1000)	10/76	0-2
North Jay	37		(1000)	10/76	0-2
Kennebunk	47	.23	1.00	-----	-----
Kennebunk	47	.50	.50	-----	-----
Kennebunkport	37		(480)	10/75	0-1
Kezar Falls	37		(400)	10/76	0-1
Lewiston	37		(40,000)	10/76	10-12
Limerick	37		(700)	10/76	0-1
Lincoln	37		(3000)	10/76	1-3
Lisbon Falls	37		(3800)	10/76	2-4
Livermore Falls	37		(5000)	10/76	3-5
Lubec	37		(1949)	10/76	1-3
Machais	37		(2000)	10/76	1-3
Madawaska	37		(6000)	10/76	3-5

Maine Five Year List Cont'd.

Municipality	Type of Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Mapleton	37		(900)	10/75	0-2
Mars Hill	47	.23	.230	10/75	-----
Mechanic Falls	37		(1400)	10/76	0-2
Milbridge	37		(200)	10/76	0-1
Millinocket	37		(8000)	10/76	5-7
Milo	37		(1250)	10/76	0-2
Mt. Desert	37		(700)	10/76	0-1
Mt. Desert-Seal Harbor	37		(300)	10/76	0-1
Mt. Desert-Somesville	37		(300)	10/76	0-1
Newport	37		(1200)	10/76	0-2
Norridgewock	37		(1964)	10/76	1-3
North Berwick	37		(1800)	-----	0-2
North Haven	37		(130)	-----	0-1
North Port	37		(20)	10/76	0-1

Maine Five Year List Cont'd.

Municipality	Type of Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
North Windham	37		(900)	-----	0-2
Oakland	37		(1500)	10/74	0-2
Old Orchard Beach	47	1.5	.662	-----	-----
Old Town	37		(8000)	10/76	5-7
Old Town Penobscott	37		(8626)	10/76	5-7
Orono, University of Maine	37		(17,350)		7-9
Paris Utility	37		(2300)	10/71	1-3 1 yr.
Patten	37		(1266)	10/76	0-2
Pittsfield	38		(3500)	10/76	------
Portland	37		(65,000)	10/76	13-15
Presque Isle	47	1.2	.900	10/76	-----
Princeton Randolf 1 yr.	49		(600)	-----	-----
Richmond	47	.25	.250	-----	-----
Rockland	37		(6560)	74	0-1

Maine Five Year List Cont'd

Municipality	Type of Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Rockport			(1000)		0-2
Rumford	37		(8000)	10/76	5-7
Saint George	37		(300)	-----	0-1
Sangerville	37		(300)	10/76	0-1
Searsport	37		(1000)	10/76	0-2
Skowhegan	37		(5000)	10/76	3-5
South Berwick	47	.46	.340	-----	-----
South Portland	37		(23,000)	10/76	8-10
Southwest Harbor	37		(1000)	10/76	0-2
Strong	37		(500)	10/76	0-1
Van Buren	37		(2000)	10/76	1-3
Veazie	37		(900)	10/76	0-2
Washburn	37		(800)	10/76	0-1
Waterville	37		(19,000)	10/76	7-9

Maine Five Year List Cont'd.

Municipality	Type of Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Wells	37		(3528)	-----	2-4
Westbrook	37		.047	10/76	0-1
Wilton	37		(1000)	10/76	0-2
Winter Harbor	37		(850)	10/76	0-1
Winterport Sanitary	37		(1000)	10/76	0-2
York	37		(5000)	-----	3-5
				TOTAL	128-270

Massachusetts Five Year List

Municipality	Type of ** Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Acton	37		(14,770)*	4/72	7-9
Amesbury	37		(8000)	6/70	5-7
Amherst	47	3.5	3.5	3/74	-----
Attleboro	39		4.0	12/73	-----
Baldwinville	37		(300)	9/74	0-1
Barre	37		(1000)	4/73	0-2
Blackstone	37		(2000)	3/73	1-3
Brockton	49	12.0	11.000	9/74	-----
Brookfield	37		(2063)	6/74	1-3
Buckland	37		.090	5/72	0-2
Charlton	47	.035	.020	4/71	-----
Chelmsford	37		(15,130)	10/73	7-9

* Figures in ( ) indicate future sewered population not MGD.

**Explanation of Plant Codes found at end of state lists.

Massachusetts Five Year List Cont'd.

Municipality	Type of Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Chester	37		(200)	5/72	0-1
Chicopee	37(47)		-----	12/74	-----
Clinton	49		3.000	-----	-----
Dartmouth	37		2.893	-----	1-3
Dighton	37		(1300)	3/72	0-2
Douglas	37		(2560)	9/73	1-3
Dudley	47	.700	.700	6/71	-----
Edgartown	37		(1475)	6/74	0-2
Erving	37		(630)	3/72	0-1
Essex	37		(2240)	1/74	8-10
Falmouth (Woods Hole)	37		(1000)	5/73	0-2
Fitchburg (West Plant)	37		-----	9/73	-----
Foxborough	39		(500)	4/73	-----
Gloucester	36		(12,000)	12/73	3-5

Massachusetts Five Year List Cont'd.

Municipality	Type of Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Grafton	37		(1000)	6/72	0-2
Great Barrington	37		.750	7/70	0-1
Greater Lawrence So. Project 1	37		-----	3/75	-----
Hardwick (Gilbertville)	37		(400)	5/70	0-1
Hardwick (Wheelwright)	37		.042	12/72	0-1
Hatfield	37		.340	5/73	2-4
Haverhill Project 1	37		-----	7/75	-----
Holyoke #3	37		15.550	12/74	7-9
Hoosic WQD	37		-----	9/74	-----
Hull	37		(2200)	12/72	1-3
Huntington	37		(1260)	3/74	0-2
Ipswich	47	.550	.040	3/74	-----
Leicester (Oxford-Roachdale)	37		(300)	4/71	0-1
Lenox (N. Lenox Plant)	37		.260	3/74	0-2

Massachusetts Five Year List Cont'd.

Municipality	Type of Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Lowell (Project 1)	37		(90,000)	3/75	17-19
Lynn	36		(96,000)	7/76	10-12
Marblehead	36		(12,700)	4/73	3-5
Marion	49		(3480)	4/72	-----
Medfield	39		(350)	5/74	-----
Medway	37		(165)	12/73	0-1
Merrimac	37		.370	1/74	2-4
Monroe	37		(216)	8/71	0-1
Montague & Erving (Millers Falls)	47		(650)	3/74	-----
Montague	37		-----	3/74	-----
Montague (City)	47	1.60	5,000	3/74	-----
Nahant	37		(2500)	6/73	1-3
New Bedford	36		(100,175)	5/70	10-12
Newburyport	47	4.5	4,500	12/74	-----

Massachusetts Five Year List Cont'd.

Municipality	Type of Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
North Adams	47	4.0	4,000	9/73	-----
Northampton	47	3.2	6,000	3/74	-----
Northbridge	49	4.4	4,400	9/71	-----
Northfield	37		.171	4/72	0-2
Norton	37		(9,487)	5/73	6-8
Orange	37		(3,800)	9/72	2-4
Palmer	37		(2,000)	9/72	1-3
Pepperell	37		(4,335)	9/73	2-4
Pittsfield	49	12.0	31,920	11/75	-----
Rockport	37		(2,000)	6/73	1-3
Royalston	37		(150)	2/72	0-1
Russell (Woronco)	37		(250)	12/73	0-1
Salisbury Center	37		(1,700)	4/72	0-2

Massachusetts Five Year List Cont'd.

Municipality	Type of Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
So. Essex Sewage District	36		-----	6/74	-----
South Hadley	47	1.5	1.500	3/74	-----
Springfield (Main Plant)	47	20.0	30.000	12/73	-----
Sturbridge	37		.700	7/70	4-6
Swampscott	36		(13,995)	4/73	4-6
Taunton	47	5.0	4.000	9/74	-----
Templeton	37		(5,863)	9/74	3-5
Upper Blackstone WPA District	37		(209,000)	1/75	30-38
Upton	37		(1,500)	-----	0-2
Uxbridge	37		(8,253)	8/74	5-7
Ware	37		2.000	9/73	8-10
Webster	37		2.000	7/74	8-10
Westfield	37		2.000	7/70	8-10
West Stockbridge	37		(1,354)	7/73	0-2

Massachusetts Five Year List Cont'd.

Municipality	Type of Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Whitman	39		(13,059)	4/72	-----
Williamstown (Project 1)	47	.025	.024	12/69	-----
				Total	212-329

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New Hampshire Five Year List

Municipality	Type of * Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Allenstown	37		.130	10/73	0-2
Antrim	37		(900)**	-----	0-2
Ashland	38		(700)	-----	-----
Berlin	37		1.500	12/75	7-9
Bethlehem	37		(2000)	-----	1-3
Boscowen (Merrimac County Home)	37		(600)	-----	0-1
Claremont	47		2.000	12/74	------
Concord (North)	37		(1000)	12/73	-----
Concord (South)	37		(4000)	-----	2-4
Conway	38		.010	6/73	-----
Dover	37		(5500)	-----	3-5
Durham	47		1.350	-----	-----
Enfield	37		(700)	-----	0-1
Epping	38		(500)	-----	-----
Farmington	37		.100	10/72	0-2

* Explanation of Plant Codes found at end of state lists.

** Figures in ( ) indicate future sewered population not MGD.

New Hampshire Five Year List Cont'd.

Municipality	Type of Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Franklin	37		(6000)	9/73	3-5
Gorham	37		.250	-----	1-3
Greenville	38		.050	-----	-----
Hampton	37		1.800	-----	7-9
Haverhill	37		(1500)	11/76	0-2
Haverhill (Grafton County Home)	37		(400)	11/74	0-1
Henniker	37		(2000)	-----	1-3
Hillsborough	38		(1500)	-----	-----
Hinsdale	37		(1500)	-----	0-2
Plymouth	47		(2500)	-----	-----
Rochester	38		.800	-----	-----
Somersworth	37		(4500)	12/73	3-5
Stewartstown (Coos County Home)	38		(500)	-----	-----
Stewartstown	38		(500)	-----	-----
Stratford	38		(300)	-----	-----

New Hampshire Five Year List Cont'd.

Municipality	Type of Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Sunapee	37		(5000)	-----	3-5
Troy	37		(2500)	-----	1-3
Warner	38		(400)	-----	-----
Westmoreland	38		(300)	-----	-----
Whitefield	38		(2000)	-----	-----
Wilton	38		(2500)	-----	-----
Winchester	38		(1500)	-----	-----
Wolfeboro	47		.140	-----	-----
				TOTAL	32-67

Rhode Island Five Year List

Municipality	Type of * Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Blackstone Valley	47	20.2	23,000	6/73	-----
Burreville	37		(9680)**	1/75	6-8
Coventry	37		(35,000)	-----	10-15
East Providence	47	4.0	4.000	-----	-----
Jamestown (East)	36		.070	7/74	0-2
Newport	46	6.0	7.600	-----	-----
North Kingstown	36		(11,600)	-----	3-5
Smithfield	37		.024	-----	8-10
South Kingstown	36		(20,000)	8/75	4-6
Tiverton	37		(10,000)	-----	6-8
Woonsocket	47	18.0	11.000	9/75	-----
				TOTAL	37-54

* Explanation of Plant Codes found at end of state lists.

** Figures in ( ) indicate future sewered population not MGD.

Vermont Five Year List

Municipality	Type of * Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Albany	37		(120)**	-----	0-1
Alburg	47		.030	-----	-----
Arlington	37		(900)	-----	0-2
Barnet	37		(100)	-----	0-1
Barre	47		1.500	10/72	-----
Barton	37		(1,170)	-----	0-2
Bellows Falls	37		1.500	-----	7-9
Bennington	47	4.5	4.700	-----	-----
Benson	38		(160)	-----	-----
Bethel	37		(900)	-----	0-2
Bradford	37		(630)	-----	0-1
Brandon	47	.84	.450	-----	-----
Brattleboro	37		1.500	-----	7-9
Bridgewater	37		(180)	9/70	0-1

* Explanation of Plant Codes found at end of state list.

**Figures in ( ) indicate future sewered population not MGD.

Vermont Five Year List Cont'd.

Municipality	Type of Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Greensboro FD #1	37		(200)	-----	0-1
Groton	37		(390)	-----	0-1
Hardwick	37		(1540)	-----	0-2
Hartford (White River)	37		(4000)	-----	3-5
Hartford (Quechee Junction)	37		(350)	-----	0-1
Hyde Park	37		(450)	-----	0-1
Jacksonville	37		(290)	-----	0-1
Lunenburg	37		(460)	-----	0-1
Lyndon	37		(2180)	-----	1-3
Marshfield	37		(310)	-----	0-1
Milton	37		(820)	-----	0-2
Morrisville	37		(2150)	-----	1-3
Newport	47	1.0	.980	-----	-----
North Troy	37		(774)	-----	0-1
Norwich	37		(1000)	-----	0-2

Vermont Five Year List Cont'd.

Municipality	Type of Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Orleans	37		(1890)	-----	1-3
Orwell	37		(300)	-----	0-1
Pawlet	37		(430)	-----	0-1
Putney	37		(370)	-----	0-1
Randolph	47	.330	.275	-----	-----
Readsboro	37		(570)	-----	0-1
Richmond	37		(840)	1/73	0-1
Rochester	37		(240)	-----	0-1
Rockingham	37		(810)	12/72	0-1
Royalton	37		(640)	-----	0-1
Ryegate (South Ryegate)	37		(490)	-----	0-1
Ryegate (West Ryegate)	37		(500)	-----	0-1
St. Albans (City)	49		4,000	-----	-----
St. Albans Bay	37		(240)	-----	0-1

Vermont Five Year List Cont'd

Municipality	Type of Plant Needed	Present MGD Cap.	Future MGD Cap.	Proj. Date of Comp.	Manpower Needed
Shelburne FD #2	47		.103	-----	-----
Sheldon	37		(280)	-----	0-1
Sheldon (Sheldon Springs)	37		(380)	-----	0-1
South Burlington	47	.800	.300	-----	-----
Stowe	37		(1000)	-----	0-2
Swanton	37		(2400)	11/72	1-3
Townsend	37		(300)	-----	0-1
Troy	37		(240)	-----	0-1
Wallingford	37		(580)	11/72	0-1
Wells River	37		(390)	-----	0-1
Williston (Tartsville)	37		(2740)	-----	1-3
Woodstock	37		(2800)	7/72	1-3
				TOTAL	23-84

Explanation of Plant Codes

1st Digit

3	Construction of new facility or replacement of existing facility with new facility
4	Upgrading the level of treatment of existing plant

2nd Digit

6	primary treatment
7	secondary treatment
8	lagoons
9	tertiary treatment

Summary

In view of the many small plants whose labor is divided equally, total operator requirements is a sufficient figure to know. Thus, a further breakdown by job classification would be somewhat meaningless.

FINDINGS AND RECOMMENDATIONS

Finding 1:

Existing municipal wastewater plants in the New England area consists of 128 primary, 179 secondary, and 10 other types of plants, a total of 317. These plants, in the summer of 1972, employed 1,748 full-time workers, (including 120 Emergency Employment Act (EEA) employees) and 132 part-time workers.

Over the next five years present plans of local and state agencies call for an additional eleven primary and 228 secondary plants, plus expansion of 63 existing plants. Based on population and proposed million gallons per day (MGD) capacity, the Boston University Research Group (Burg) estimates that 2,245 to 2,805 additional workers will be needed for the new and expanded facilities through 1976.

Separations and retirements will also require replacement of almost 969 of the workers in the above total in the next five years. Additionally, there are at present 110 vacancies in New England wastewater pollution control plants.

A low level of training was reported, with over half the employees indicating no training, the median training reported in the New England states ranged from approximately 40 hours to 120 hours. Operations Supervisors, Superintendents, and Sole Operators (see definitions in Appendix B) had the most training while operators generally seemed to lack training. Workers criticized the heavy emphasis on academic content and would have preferred more practical application in training courses. Often times workers complained of the distances between training centers and home plants. Also, because of limited training facilities, restrictions on how many workers from each plant were allowed to attend was found to be a problem. Entry level personnel were, at times, trained for non-existant jobs.

Recommendation 1:

Additional training facilities should be provided at a number of geographically dispersed locations. No limits should be placed on number of referrals from any plant and class openings should be approximately doubled from present levels. If possible, greater use of traveling training facilities should be encouraged. Practical applications should be stressed rather than academic aspects. Type of training programs should be correlated with projected job openings. Training for promotion should as much as possible be planned to coincide with definite job openings.

Environmental Protection Agency (EPA) should assist in the development of courses at junior colleges and technical schools in wastewater treatment, and industry representatives should participate in offering courses. Job openings and opportunities should be publicized through guidance and vocational counselors in New England schools.

Finding 2:

Salaries of many administrators are comparable to those for similar positions in private industry. However, although comparisons are difficult to make of specialized occupations within the wastewater industry, other wastewater occupations tend to be more poorly paid than a worker performing similar duties in private industry. This may in part explain the high quit rate and the number of outstanding vacancies. It also appeared that the significance of unions on wages is minimal.

A further difficulty of recruitment is that generally only local residents are considered for job openings, thus limiting the potential labor market.

Recommendation 2:

Positions in the wastewater field should be upgraded in salary to be competitive with similar level jobs in private industry. Civil service type procedures should be set up to ensure widespread announcement and recruitment of highest quality personnel, including labor markets beyond the immediate locality of the plant.

Finding 3:

Excellent cooperation was obtained from all federal, state and local agencies concerned with water pollution control. However, there was at times some uncertainty over sources of information or jurisdictional problems.

Recommendation 3:

Semi-annual meetings, supplemented by dissemination of a newsletter on current progress and technical notes in the water pollution control field might help eliminate unnecessary duplication of effort.

Finding 4:

Local plant officials and operators frequently complained that budget officials of towns or cities lacked expertise in evaluating requests for technical equipment needed for efficient and effective operation of wastewater plants. This was also true of requests for needed manpower.

Recommendation 4:

Authority should be centralized at the regional level with inspecting teams financed through state and federal funds making monthly visits to insure proper operation of plants for the health and safety of plant personnel and surrounding communities. Regional authority would be better suited for increased cooperation between plants and better regional management of the environment. Regional Authorities would be in a stronger position to upgrade salaries and make them more uniform.

Finding 5:

Certification programs vary in quality between states. This may inhibit mobility and permit some poorly trained operators to find employment in some states.

Existing certification programs are not effectively enforced and often weakened by legislation permitting "trainee" classification. Certification programs in New England tended to emphasize length in industry far too much.

Recommendation 5:

Uniform New England certification requirements should be made mandatory and be strictly enforced for both private and public plants. Fines should be assessed against offending cities and towns which employ non-certified workers in positions requiring certification. Certified workers should be able to operate throughout the New England area. Certification regulations should stress ability and training rather than time spent in industry.

Finding 6:

The process of visiting wastewater facilities, reading the literature, and discussing problems with practitioners has greatly increased the understanding of the BURG with respect to problems of pollution control and the necessity of prompt and vigorous action in this field. From all indications, the general public is unaware of the seriousness of these problems.

Recommendation 6:

Greater effort should be made by EPA and other state and local agencies, using the media and the schools to acquaint the public with the problems and the need to maintain an efficient and well-qualified labor force in wastewater facilities.

APPENDIX A

Municipal Wastewater Treatment Plants
Visited in Connecticut

Plant Location	Mailing Address
Ansonia	Mr. John Lombardi Superintendent c/o City Hall 253 Main Street Ansonia, Connecticut 06401
Beacon Falls	Mr. James Greene Operator Town Hall Beacon Falls, Connecticut 06403
Bethel	Mr. Jack Gakeler Operator c/o Sewer Authority P.O. Box 211 Bethel, Connecticut 06801
Branford	Mr. Thomas O'Tell Superintendent Block Island Road Branford, Connecticut 06405
Bridgeport, East Side	Mr. Robert O'Loughlin Chief Operator 695 Seaview Avenue Bridgeport, Connecticut 06610
Bridgeport, West	Mr. Omer Poirer Chief Operator 205 Bostwick Avenue Bridgeport, Connecticut 06610
Bristol, Main	Mr. Roy Love Chief Operator 75 Plant Road Bristol, Connecticut 06010
Bristol, Forestville	Mr. Frank Mitte P.O. Box 143 Forestville, Connecticut 06010
Canton	Mr. Robert Scarton Operator River Road Collinsville, Connecticut 06022

Municipal Wastewater Treatment Plants

Visited in Connecticut (Cont'd.)

Plant Location	Mailing Address
Cheshire	Mr. James Therlault Chief Operator Cheshire Street Cheshire, Connecticut
Cromwell	Mr. John Szymanski The Mattabasett Post Regional Sewer Authority P.O. Box 137 Cromwell, Connecticut 06416
Danbury	Mr. Frank Cernrvay Superintendent City of Danbury Waste Treatment Plant Old Newton Road Danbury, Connecticut 06810
Darien	Mr. Charles Raymond Chief Operator W.P.C.P. 173 Nearwater Lane Darien, Connecticut 06821
Derby	Mr. Louis Walenga Operator Town Hall Derby, Connecticut 06418
East Hartford	Mr. Raymond Laweny Chief Operator 17 Pitkin Street East Hartford, Connecticut 06101
East Windsor	Mr. Robert Raber Superintendent 25 Cricker Road Warehouse Point, Connecticut 07088
East Windsor - Broad Brook	

Municipal Wastewater Treatment Plants
Visited in Connecticut (Cont'd)

Plant Location	Mailing Address
Enfield	Mr. Archie Buck Superintendent Sewer Department Bridge Lane Enfield, Connecticut
Fairfield	Mr. James Feher Superintendent One Rod Highway Fairfield, Connecticut
Farmington	Mr. Paul Barker Superintendent Sewage Treatment Plant Farmington, Connecticut
Glastonburg	Mr. Alvin Bean Superintendent c/o Town Hall Building Glastonburg, Connecticut
Granby	Mr. Ivan Hotchkiss Granby Sewer Commission Town Hall Granby, Connecticut
Greenwich	Mr. Franklin Flower Chief Operator c/o Town Hall Annex Greenwich, Connecticut
Griswold	Mr. Gerald St. Germain Chief Operator Sewage Treatment Plant Wedgewood Drive Jewett City, Connecticut
Groton (city)	Mr. William Clinton Groton Pollution Abatement Facility P.O. Box 889 Groton, Connecticut 06340
Groton (town)	Mr. Adolph Luckner Chief Operator 4 Health Street Mystic, Connecticut 06355

Municipal Wastewater Treatment Plants

Visited in Connecticut (Cont'd)

Plant Location	Mailing Address
Hartford	Mr. E. A. Lowsz Executive Engineer P.O. Box 800 Hartford, Connecticut 06101
Kent	Mr. Arthur Seaburg Superintendent Kent City Hall Kent, Connecticut
Killingly	Mr. Paul Trahan Chief Operator Borough of Danielson, STP P.O. Box 68 Danielson, Connecticut
Litchfield	Mr. Theodore Legendre Superintendent c/o Town Hall Litchfield, Connecticut
Manchester	Mr. Stanley Lambert Superintendent c/o Water Sewer Department 277 Olcott Street Manchester, Connecticut 06040
Manchester	Mr. Calvin Taggart Chief Operator 119 Woodland Street Manchester, Connecticut 06040
Meirder	Mr. Bruno Nicholai Superintendent Evansville Avenue Meirder, Connecticut 06450
Middletown	Mr. Samuel Moncata Superintendent 34 East Main Street Middletown, Connecticut 06547
Middletown	Connecticut Valley Hospital Middletown, Connecticut

Municipal Wastewater Treatment Plants
Visited in Connecticut (Cont'd)

Plant Location	Mailing Address
Milford - Gulf Pond W.P.C.F.	Mr. Clark Green Superintendent Department of Public Works City Hall River Street Milford, Connecticut 06460
New Haven - East Shore	Mr. Wood Beejhly Operator Hall of Records 200 Orange Street New Haven, Connecticut 06515
New London - Trumbull Street	Mr. Frank Bednay Superintendent Trumbull Street New London, Connecticut 06301
New London, Riverside	Trumbull Street New London, Connecticut 06301
Norwich	Mr. Arthur LeBlanc Superintendent Department of Public Utilities 34 Shetucket Street Falls Avenue Norwich, Connecticut 06360
Plainfield	Mr. John Oates Operator c/o Town Hall Plainfield, Connecticut 06374
Plainville	Mr. Edward Griffin Chief Operator Norton Place Plainville, Connecticut 06062
Plymouth	Mr. George Kensiski Operator P.O. Box 101 Terryville, Connecticut 06786
Portland	Mr. Andrew Pyne Operator c/o Town Hall Portland, Connecticut 06480

Municipal Wastewater Treatment Plants
Visited in Connecticut (Cont'd)

Plant Location	Mailing Address
Putnam	Mr. Roland Lannon Chief Operator Sewage Treatment Plant Putnam, Connecticut 06260
Ridgefield	Mr. Anthony Smith Operator Sewage Treatment Plant Putnam, Connecticut 06260
Milford - Harbor W.P.C.F.	Mr. Lawrence Hornyak Chief Operator Department of Public Works City Hall River Street Milford, Connecticut 06460
Milford - Town Meadows W.P.C.F.	Mr. Joseph Martino Chief Operator Department of Public Works City Hall River Street Milford, Connecticut 06460
Milford - Dexon Plant	
Navgatvack	Cherry Street Navgatvack, Connecticut 06770
New Canaan	Mr. Fred Mazzella Superintendent South Main Street New Canaan, Connecticut 06840
New Hartford	Mr. Joseph Chirico P.O. Box 246 New Hartford, Connecticut 06057
New Haven - Boulevard W.P.C.F.	Mr. John Eickler Operator Hall of Records 200 Orange Street New Haven, Connecticut 06515

Municipal Wastewater Treatment Plants
Visited in Connecticut (Cont'd)

Plant Location	Mailing Address
New Haven - East Street	Mr. Steve Lyons Operator Hall of Records 200 Orange Street New Haven, Connecticut 06515
Rockyhill	Mr. Harold Johnston c/o P.O. Box 800 Hartford, Connecticut
Salisbury	Chief Operator Town Hall Salisbury, Connecticut 06068
Seymour	Stephen Cherhoniak Chief Operator Sewage Disposal Plant Route 8 Seymour, Connecticut
Shelton	Mr. Leroy Hellman Riverdale Avenue Shelton, Connecticut 06484
Shelton - Rte. 8 Plant	Mr. Leroy Hellman Riverdale Avenue Shelton, Connecticut 06484
Southington	Louis J. Theriault Chief Operator Sewage Treatment Plant South End Street Southington, Connecticut 06489
South Windsor	Mr. Harvey Levack Sewage Treatment Plant c/o Town Hall South Windsor, Connecticut 06074
Sprague	Matthew J. Delaney First Selectman c/o Town Hall Baltic, Connecticut 06330

Municipal Wastewater Treatment Plants
Visited in Connecticut (Cont'd)

Plant Location	Mailing Address
Stafford	Steven Dowle Chlr. Sewer Commission 57 Prospect Street Stafford Springs, Connecticut 06076
Stamford	Superintendent Water Pollution Control Facility Harborview Avenue Stamford, Connecticut 06906
Stonington	Superintendent Water Pollution Control Facility Mystic, Connecticut
Stratford	Joseph Hunyadi Superintendent Sewage Treatment Plant Birdseye Street Ext. Stratford, Connecticut 06497
Suffield	Mr. Nick Maltese Operator P.O. Box 275 Suffield, Connecticut 06078
Thomaston	Superintendent W.P.C.F. P.O. Box 57 Thomaston, Connecticut 06787
Torrington - Rte. 8 W.P.C.F.	Mr. Charles J. Hewitt Chief Operator c/o City Hall Torrington, Connecticut 06790
Torrington - Burrville Plant	c/o City Hall Torrington, Connecticut 06790
Vernon	Mr. Charles Pitkat Superintendent W.P.C.F. P.O. Box 265 Rockville, Connecticut 06066
Wallingford	Mr. Salvatore Falconieri Superintendent Sewer Division P.O. Box 725 Wallingford, Connecticut 06492

Municipal Wastewater Treatment Plants

Visited in Connecticut (Cont'd)

Plant Location	Mailing Address
Waterbury	Mr. Walter M. Kunsch Superintendent c/o City Engineer City Hall Waterbury, Connecticut 06702
Watertown	Chief Operator
West Haven	Mr. John Norton Superintendent c/o City Hall 355 Main Street West Haven, Connecticut 06516
Westport	Mr. Vincent Rotondo Superintendent 8 Mansfield Place Westport, Connecticut 06880
Winsted	Mr. Alvin Charlton Chief Operator 50 Woodland Street Winsted, Connecticut 06098
Windham - Willimantic	Mr. Edward J. Cichon Chief Operator Willimantic, Connecticut 06226
Windsor (Poquonack W.P.C.F.)	Mr. John Laraia Chief Operator c/o Box 800 Hartford, Connecticut 06101
Windsor Locks	Mr. Glista Superintendent Windsor Locks W.P.C.F. Stanton Road Windsor Locks, Connecticut 06096

Municipal Wastewater Treatment Plants

Visited in Maine

Plant Location	Mailing Address
Ashland Water and Sewer District	Mrs. Lillian Winslow Ashland Water and Sewer District Ashland, Maine
Augusta Sewer District	Mr. Charles Evers 25 Week Street Augusta, Maine
Bangor	Mr. Ralph Mishov Bangor Sewage Treatment Plant c/o City Hall Bangor, Maine
Bath	Sewage Treatment Plant Bowery Street Bath, Maine
Biddeford	Mr. Robert Dodge Sewage Treatment Plant P.O. Box 146 Biddeford, Maine
Bingham	Mr. Vinal Adams P.O. Box 506 Bingham, Maine 04920
Booth Bay Harbor Sewer District	Mr. Mark Leaman Sewage Treatment Plant Sea Street Booth Bay Harbor, Maine
Brunswick Sewer District	Mr. Richard Goodnoor 28 Federal Street Brunswick, Maine
Calais	Mr. Douglas Moore 9 Elm Street Calais, Maine
Camden	Mr. Frank Stearns Sewer Department P.O. Box 697 Camden, Maine

Municipal Wastewater Treatment Plants
Visited in Maine (Cont'd)

Plant Location	Mailing Address
Cape Elizabeth	Mr. Fred Williams Public Works Ocean House Road Cape Elizabeth, Maine
Caribou Utility District	Mr. Claude Lombard Sewage Treatment Plant c/o City Hall Caribou, Maine
Corinna Sewer District	Mr. Paul Perkins Corinna Treatment Plant Corinna, Maine
Falmouth	Mr. James Taplin Sewer Department Falmouth, Maine
Fort Kent Sewer Department	Mr. Alberte Nadeau Sewage Treatment Plant c/o Town Office Fort Kent, Maine
Freeport Sewage District	Mrs. White Sewer Department Freeport, Maine
Kennebunk Sewer District	Mr. Richard Leureux Kennebunk Sewer District Kennebunk, Maine
Kennebunk - Booth Bay Road Plant	Mr. Roland Leureux Kennebunk Sewer District Kennebunk, Maine
Kittery	Mr. Leslie Dorr City Hall Kittery, Maine
Limestone Water and Sewerage District	Mr. Freddie Pelletier Limestone Water and Sewage District Limestone, Maine
Mars Hill Utility District	Mr. Ray C. Jones P.O. Box 259 Mars Hill, Maine

Municipal Wastewater Treatment Plants
Visited in Maine (Cont'd)

Plant Location	Mailing Address
Mt. Desert	Mr. Carlton Taylor Grover Avenue, Rte. 3 Otter Creek, Maine
Norway	Superintendent of Sewers Town Offices Norway, Maine
Ogunquit Sewer District	Mr. Lynard Wyman Sewerage District 34 Shore Road Ogunquit, Maine
Old Orchard Beach Sewer District	Mr. Edward Townsend Box 45 Old Orchard Beach, Maine
Orono	Sewerage Treatment Plant c/o City Hall Orono, Maine
Pleasant Point - Passarnaguoddy Housing Authority	Mr. Roy Nipton Housing Authority Pleasant Point, Maine
Portland Public Works Department	Mr. Dave Crockett Sewer Department 389 Congress Street Portland, Maine
Presque Isle Sewer District	Mr. Kenneth Easler Water and Sewage District Second Street Presque Isle, Maine
Rangeley	Mr. Gerome Guenremont Department of Sewers Robbins Road Rangeley, Maine
Richmond Utilities	Mr. Lloyd Walker Box 187 Richmond, Maine
Saco - Bear Brook Plant	Mr. Timothy Crowley Sewerage Treatment Plant c/o City Hall Saco, Maine

Municipal Wastewater Treatment Plants
Visited in Maine (Cont'd)

Plant Location	Mailing Address
Saint Agatha Sanitary District	Mr. Leo Morneault Sewerage Treatment Plant Saint Agatha, Maine
Sanford Sewer District	Mr. Arthur Bergeron Sewerage Treatment Plant Box 338 Springvale, Maine
Scarborough	Mr. Raymond Fields Box 312 Scarborough, Maine
South Berwick Sewer District	Mr. Harold Clough Sewer Department South Berwick, Maine
Thomaston	Mr. Arthur Risteen Sewerage Treatment Plant c/o City Hall Thomaston, Maine
Waldoboro Sewer District	Sewerage Treatment Plant c/o Town Hall Waldoboro, Maine
Wiscasset	Mr. Glenwood Lamson Sewerage Treatment Plant c/o Town Offices Wiscasset, Maine
Yarmouth	Mr. Melvin Cash Sewerage Treatment Plant Princess Point Road Yarmouth, Maine

Municipal Wastewater Treatment Plants

Visited in Massachusetts

Plant Location	Mailing Address
Abington	Mr. Johnson Superintendent of Sewers c/o Highway Department Abington, Massachusetts
Adams	Mr. Dick Johnson Superintendent Adams Sewage Treatment Plant 279 Columbia Street Adams, Massachusetts
Amherst	Chief Operator Town of Amherst Sewage Treatment Plant Amherst, Massachusetts
Andover	Mr. McQuade Director, D.P.W. 20 Main Street Andover, Massachusetts 01810
Athol	Ralph Cutter Superintendent Athol Sewage Treatment Plant c/o Department of Public Works Memorial Building, Room 17 Athol, Massachusetts 01331
Attleboro	Mr. Louis Lamowriex Superintendent Attleboro Sewage Treatment Plant D.P.W. - W.P.C.F. 29 Park Street Attleboro, Massachusetts 02703
Ayer	Mr. Dumas Sewage Treatment Plant c/o Department of Public Works Brook Street Ayer, Massachusetts
Barnstable (Hyannis)	Mr. Kenneth S. Bearse Superintendent of Sewer Department Town of Barnstable 897 Main Street Hyannis, Massachusetts 02601

Municipal Wastewater Treatment Plants
Visited in Massachusetts (Cont'd)

Plant Location	Mailing Address
Billerica (Letchworth)	Sewage Treatment Plant Letchworth Avenue North Billerica, Massachusetts
Bridgewater	Chief Operator Bridgewater Sewage Treatment Plant Morris Avenue Bridgewater, Massachusetts
Brockton	Mr. Tim Murphy Superintendent Brockton Sewage Treatment Plant Brockton, Massachusetts
Charlton	Mr. Minor Sewage Department Charlton, Massachusetts
Chicopee	Mr. Leon Sisitsky Medina Street Chicopee, Massachusetts
Chatham	Mr. Leo Tarrenkopf Box 183 Chatham, Massachusetts
Clinton	Mr. Edward Garrity c/o Wachusett Dam M.D.C. Clinton, Massachusetts 01510
Cohasset	Mr. Marvel Salvador Sewage Treatment Plant 43 Elm Street Cohasset, Massachusetts
Concord	Director of Public Works Off Lowell Road Concord, Massachusetts
Dartmouth	Mr. Dave Andrade 759 Russel Mills Road South Dartmouth, Massachusetts
Deer Island (M.D.C.)	Mr. M. Wise Sewage Treatment Plant - Deer Island Winthrop, Massachusetts

Municipal Wastewater Treatment Plants
Visited in Massachusetts (Cont'd)

Plant Location	Mailing Address
Deerfield - O.I.D.	
Deerfield - South	
Dracut	Mr. George Chouland Waste Water Treatment Plant Lakeview Avenue Dracut, Massachusetts
Dudley	Mr. William Carroll, Jr. Dudley Sewage Department P.O. Box 12 Dudley, Massachusetts
East Hampton	Mr. Leward Carey Sewage Plant Operator c/o Town Hall East Hampton, Massachusetts
Fair Haven	Mr. Alfred Raphael Sewage Treatment Plant Arsene Street Fair Haven, Massachusetts
Fall River	Mr. Ray Foley Superintendent Sewage Treatment Plant Bay Street Fall River, Massachusetts
Fitchburg	Sewage Department c/o Town Hall Fitchburg, Massachusetts
Foxboro	Mr. Truax Foxboro Sewage Treatment Plant c/o Town Offices 30 South Street Foxboro, Massachusetts

Municipal Wastewater Treatment Plants
Visited in Massachusetts (Cont'd)

Plant Location	Mailing Address
Franklin	Town of Franklin Department of Public Works Sewer Division Franklin, Massachusetts
Gardner	Mr. John Meany Superintendent Gardner Sewage Treatment Plant City Hall Pleasant Street Gardner, Massachusetts
Greenfield	Town of Greenfield Department of Public Works c/o Town Hall Greenfield, Massachusetts
Hadley	Mr. Raymond D. Shipman Hadley Sewage Treatment Plant c/o Town Hall Hadley, Massachusetts
Holyoke	Mr. M. J. O'Donnell Superintendent Holyoke Sewage Treatment Plant 24 Commercial Street Holyoke, Massachusetts
Hopedale	Mr. Ben Phillips Superintendent Hopedale Sewage Treatment Plant c/o Town Hall Hopedale, Massachusetts
Hudson	Mr. Lapine Superintendent Hudson Sewage Treatment Plant c/o Town Hall Hudson, Massachusetts
Ipswich	Mr. Kevin McElhinney Ipswich Sewage Treatment Plant Department of Public Works c/o Town Hall Ipswich, Massachusetts

Municipal Wastewater Treatment Plants

Visited in Massachusetts (Cont'd)

Plant Location	Mailing Address
Lee	Mr. Henry Loring Superintendent Waste Water Pollution Control Plant Route 102 Pleasant Street Lee, Massachusetts
Leicester	Mr. Alvin Wright Superintendent Leicester Sewage Treatment Plant Box 86 Leicester, Massachusetts
Lenox - main	Mr. Wallace Bronson Superintendent Lenox Waste Water Plant Crystal Street Lenox, Massachusetts
Lenox - north	See Lenox - main
Leominster	Supervisor Leominster Sewage Treatment Plant c/o Town Hall Leominster, Massachusetts
Longmeadow	Mr. Raymond Schneider Chief Operator Longmeadow Sewage Treatment Plant c/o Town Hall Longmeadow, Massachusetts
Ludlow	
Mansfield	Mr. Hebard Chief Operator Water and Sewer Department 131 North Main Street Mansfield, Massachusetts
Manchester	Mr. Don Doan Manchester Sewage Treatment Plant c/o Town Hall Manchester, Massachusetts

Municipal Wastewater Treatment Plants Visited in Massachusetts (Cont'd)

Plant Location	Mailing Address
Marion	Mr. Manuel Casta Chief Operator Marion Sewage Treatment Plant c/o Town Hall Marion, Massachusetts
Marlboro - east	Mr. John Hartly Superintendent East Marlboro Sewage Treatment Plant c/o Department of Public Works Neil Street Marlboro, Massachusetts 01751
Marlboro - west	Plant Foreman West Marlboro Sewage Treatment Plant c/o Town Hall Marlboro, Massachusetts
Marshfield	Mr. Carver Marshfield Sewage Treatment Plant c/o Department of Public Works Town Hall Marshfield, Massachusetts
Maynard	Supervisor Maynard Sewage Treatment Plant c/o Town Hall Maynard, Massachusetts
Medfield	Supervisor Medfield Sewage Treatment Plant c/o Highway Department Town Hall Medfield, Massachusetts
Middleborough	Supervisor Middleborough Sewage Treatment Plant c/o Water Department Wareham Street Middleborough, Massachusetts 02346
Milford	Mr. John Roberti Milford Sewage Treatment Plant c/o Town Hall Milford, Massachusetts

Municipal Wastewater Treatment Plants Visited in Massachusetts (Cont'd)

Plant Location	Mailing Address
Millbury	Mr. Kurt Gaffrey Superintendent Millbury Sewage Treatment Plant c/o Town Hall - Sewage Department Millbury, Massachusetts
Millis	Mr. Emil Venderber Superintendent Millis Sewage Treatment Plant c/o Department of Public Works Water Street Millis, Massachusetts
Montague	Supervisor Montague Sewage Treatment Plant c/o Town Hall Montague, Massachusetts
Monroe	
Nantucket	
Newburyport	Supervisor Newburyport Sewage Treatment Plant c/o Town Hall Newburyport, Massachusetts
North Adams	Mr. George Seisler Superintendent North Adams Sewage Treatment Plant North Adams, Massachusetts
North Attleboro	Mr. Pat Grimaldi Supervisor Sewer Department 240 Smith Street North Attleboro, Massachusetts

Municipal Wastewater Treatment Plants
Visited in Massachusetts (Cont'd)

Plant Location	Mailing Address
North Brookfield	Mr. William Goulette Superintendent North Brookfield Sewage Treatment Plant c/o Highway Department Summer Street North Brookfield, Massachusetts
Northfield	Mr. Walford Mecham Superintendent Northfield Sewage Treatment Plant Turnpike Road S.R.F.D. Northfield, Massachusetts
Northampton	Superintendent Northampton Sewage Treatment Plant Hockanum Road Northampton, Massachusetts 01060
Northbridge	Superintendent Northbridge Sewage Treatment Plant c/o Town Hall Northbridge, Massachusetts
Nut Island (M.D.C.)	Mr. R. W. Giddens Superintendent Nut Island Sewage Treatment Plant 147 Sea Avenue Quincy, Massachusetts 02169
Pittsfield	Mr. William Fallon Superintendent Pittsfield Sewage Treatment Plant Home Road Pittsfield, Massachusetts
Plymouth	Plymouth Sewer Department Water Street Plymouth, Massachusetts 02360
Rockland	Superintendent Rockland Sewage Treatment Plant c/o Town Hall Rockland, Massachusetts

Municipal Wastewater Treatment Plants
Visited in Massachusetts (Cont'd)

Plant Location	Mailing Address
Russell	Mr. Gerald Sikes Superintendent c/o Town Hall Board of Selectmen Russell, Massachusetts
Scituate	Superintendent Scituate Sewage Treatment Plant c/o Town Hall Scituate, Massachusetts
Shrewsbury	Mr. Chaput Superintendent Shrewsbury Sewage Treatment Plant c/o Municipal Building Sewage Department 100 Maple Avenue Shrewsbury, Massachusetts
Somerset	Town of Somerset Sewer Department Walker Street Somerset, Massachusetts
Southbridge	Mr. Arthur Levesque Superintendent Department of Sewers Town Hall Southbridge, Massachusetts
South Hadley	Superintendent South Hadley Sewage Treatment Plant c/o Highway Department Town Hall South Hadley, Massachusetts
Spencer	Superintendent Spencer Sewage Treatment Plant c/o Town Hall Spencer, Massachusetts
Springfield - Indian Orchard	See - Springfield - main
Springfield - main	Superintendent Springfield Sewage Treatment Plant Springfield, Massachusetts

Municipal Wastewater Treatment Plants

Visited in Massachusetts (Cont'd)

Plant Location	Mailing Address
Stockbridge	Mr. Arthur Nelson Superintendent Stockbridge Sewage Treatment Plant Proctor Hall Stockbridge, Massachusetts
Sturbridge	Mr. William Cahoon Superintendent Sturbridge Sewage Treatment Plant P.O. Box 253 Sturbridge, Massachusetts
Sunderland	Supervisor Sunderland Sewage Treatment Plant c/o Town Hall Sunderland, Massachusetts
Taunton	Mr. Paul Manter Plant Supervisor Taunton Sewage Treatment Plant West Water Street Taunton, Massachusetts
Upton	Superintendent Upton Sewage Treatment Plant c/o Town Hall Upton, Massachusetts
Ware	Mr. Ray Harden Superintendent Ware Sewage Treatment Plant Robbins Road Ware, Massachusetts
Warren	Mr. John Boudy Warren Sewage Treatment Plant c/o Sewer Department Town Hall Warren, Massachusetts
Webster	Mr. Edward Collins Superintendent Webster Sewage Treatment Plant Webster, Massachusetts

Municipal Wastewater Treatment Plants
Visited in Massachusetts (Cont'd)

Plant Location	Mailing Address
Westboro	Mr. Thurbur Superintendent Westboro Sewage Treatment Plant c/o Town Hall Westboro, Massachusetts
Williamstown	Mr. Edward H. McGowan Superintendent Williamstown Sewage Treatment Plant c/o Town Hall Williamstown, Massachusetts
Winchendon	Superintendent Winchendon Sewage Treatment Plant c/o Town Hall Winchendon, Massachusetts
Worcester	Mr. Garabedian Superintendent Worcester Sewage Treatment Plant 20 East Worcester Street Worcester, Massachusetts

Municipal Wastewater Treatment Plants

Visited in New Hampshire

Plant Location	Mailing Address
Ashland	Mr. Hughes Superintendent Ashland Sewage Treatment Plant c/o Town Hall Ashland, New Hampshire
Bristol	Mr. Thomas Morzcion Superintendent Bristol Sewage Treatment Plant c/o Town Hall Bristol, New Hampshire
Center Harbor - Moultonboro Bay District	Mr. Jack Edwards Superintendent Center Harbor/Moultonboro Sewage Treatment Plant Center Harbor, New Hampshire
Charlestown	Superintendent Charlestown Sewage Treatment Plant c/o Water and Sewage Department Charlestown, New Hampshire
Claremont	Superintendent Claremont Sewage Treatment Plant c/o Town Hall Claremont, New Hampshire
Colebrook	Mr. Donald Dickson Commissioner Colebrook Sewage Treatment Plant c/o Town Hall Colebrook, New Hampshire
Derry	Mr. Marc McDermott Superintendent Derry Sewage Treatment Plant 40 Fordway Street Derry, New Hampshire
Dover - domestic	Mr. Alfred Richards Superintendent Dover Sewage Treatment Plant c/o City Hall Dover, New Hampshire

Municipal Wastewater Treatment Plants
Visited in New Hampshire (Cont'd)

Plant Location	Mailing Address
Durham	Mr. Robert Bouck Superintendent Durham Wastewater Treatment Plant Durham, New Hampshire
Epping	Mr. Robert Chamberlain Superintendent Epping Sewage Treatment Plant c/o Town Hall Epping, New Hampshire
Exeter	Mr. Nelson Belanger Superintendent Exeter Sewage Treatment Plant c/o Sewage Department Water Street Exeter, New Hampshire
Goffstown	Superintendent Goffstown Sewage Treatment Plant c/o Town Hall Goffstown, New Hampshire
Groveton	Superintendent Groveton Sewage Treatment Plant c/o Town Hall Groveton, New Hampshire ATT: Town Manager
Hampton	Mr. Leavitt McGrath Superintendent Hampton Sewage Treatment Plant c/o Public Works Department Tide Mill Road Hampton, New Hampshire
Hanover	Superintendent Hanover Sewage Treatment Plant c/o Sewer Department Town Hall Hanover, New Hampshire
Hooksett	Mr. Page Superintendent Hooksett Sewage Treatment Plant c/o Town Hall Hooksett, New Hampshire

Municipal Wastewater Treatment Plants
Visited in New Hampshire (Cont'd)

Plant Location	Mailing Address
Jaffrey	Superintendent Jaffrey Sewage Treatment Plant c/o Highway Department Jaffrey, New Hampshire
Keene	Superintendent Keene Sewage Treatment Plant c/o City Hall Keene, New Hampshire
Laconia	Mr. Arthur Sinclair Superintendent Laconia Sewage Treatment Plant c/o City Hall Laconia, New Hampshire
Littleton	Mr. Ira Allen Superintendent Littleton Sewage Treatment Plant c/o Town Hall Littleton, New Hampshire
Lincoln	Superintendent Lincoln Sewage Treatment Plant c/o Town Hall Lincoln, New Hampshire
Meredith	Mr. Fred Rollins Superintendent Meredith Sewage Treatment Plant c/o Town Hall Meredith, New Hampshire
Merrimack	Superintendent Merrimack Sewage Treatment Plant c/o Town Hall Merrimack, New Hampshire
Nashua	Superintendent Nashua Sewage Treatment Plant c/o City Hall Nashua, New Hampshire
Newbury	Superintendent Newbury Sewage Treatment Plant c/o Town Hall Newbury, New Hampshire

Municipal Wastewater Treatment Plants
Visited in New Hampshire (Cont'd)

Plant Location	Mailing Address
New Hampton	Mr. McDan Commissioner New Hampton Sewage Treatment Plant c/o Town Hall New Hampton, New Hampshire
New London	Superintendent New London Sewage Treatment Plant c/o Town Hall New London, New Hampshire
Newmarket	Mr. Driscoll Green Superintendent Newmarket Sewage Treatment Plant c/o Town Hall Newmarket, New Hampshire
Newport	Mr. William Rose Manager Newport Sewage Treatment Plant 35 Main Street Newport, New Hampshire
North Woodstock	Mr. William Miller Superintendent North Woodstock Sewage Treatment Plant Box 437 North Woodstock, New Hampshire
Peterborough	Mr. Tom Weeks Foreman Peterborough Sewage Treatment Plant c/o Department of Public Works Peterborough, New Hampshire
Plymouth	Mr. John Woods Superintendent Plymouth Sewage Treatment Plant c/o Court House Main Street Plymouth, New Hampshire

Municipal Wastewater Treatment Plants
Visited in New Hampshire (Cont'd)

Plant Location	Mailing Address
Portsmouth - Pierce Isle	Mr. W. Finenco Superintendent Portsmouth Wastewater Treatment Plant c/o Department of Public Works 700 Islington Street Portsmouth, New Hampshire
Portsmouth - Seacrest Hill	See Portsmouth - Pierce Isle
Rollinsford	Mr. Lester Eldridge Superintendent Rollinsford Sewage Treatment Plant c/o Town Hall Rollinsford, New Hampshire
Salem	Superintendent Salem Sewage Treatment Plant c/o Town Hall Salem, New Hampshire
Wolfeboro	Mr. Fred Osgood Superintendent Wolfeboro Sewage Treatment Plant c/o Town Hall Wolfeboro, New Hampshire

Municipal Wastewater Treatment Plants

Visited in Rhode Island

Plant Location	Mailing Address
Bristol	Bristol Sewer Commission 62 Franklin Street Bristol, Rhode Island
Bucklin Point - E. Providence	Mr. A. McLoughlin Blackstone Valley Sewer Commission P.O. Box A Rumford, Rhode Island 02906
Cranston	Mr. A. Ventatuolo Superintendent Cranston Sewage Treatment Plant Glen Road Cranston, Rhode Island
East Greenwich	Mr. Ed Johnson Superintendent East Greenwich Sewage Treatment Plant Crompton Avenue East Greenwich, Rhode Island
East Providence	Mr. Ernest Monroe East Providence Sewage Treatment Plant Crest Avenue Riverside, Rhode Island
Newport	Mr. Raymond Lynch Sanitation Department Connell Highway Newport, Rhode Island 02840
Providence	Mr. Benson Providence Sewage Treatment Plant 2 Ernest Street Providence, Rhode Island
Warren	Mr. Oliver Rene Town of Warren Sewer Commission Box 195 Warren, Rhode Island
Narragansett - Narragansett Pier	Mr. Bampton Narragansett Town Engineer Town Hall Narragansett, Rhode Island

Municipal Wastewater Treatment Plants
Visited in Rhode Island (Cont'd)

Plant Location	Mailing Address
Warwick	Mr. Maynard Superintendent Warwick Sewage 300 Service Avenue Warwick, Rhode Island
Westerly	Mr. Joseph Carwell Superintendent Sewage Treatment Plant Margin Street Westerly, Rhode Island
West Warwick	Mr. Bernard DiCarlo Superintendent West Warwick Sewage Treatment Plant Pontiac Avenue West Warwick, Rhode Island
Woonsocket	Mr. Russell Horne Superintendent of Water and Sewers 169 Main Street Woonsocket, Rhode Island 02895
Narragansett - Scarborough Hills	See Narragansett - Narragansett Pier

Municipal Wastewater Treatment Plants

Visited in Vermont

Plant Location	Mailing Address
Alburg	Mr. Ralph Rush Superintendent Alburg Sewage Treatment Plant Village of Alburg Alburg, Vermont
Barre City	Mr. Robert Searles Superintendent Barre City Sewage Treatment Plant 27 East Street Barre, Vermont
Barre Town	Mr. Jim Gordon Superintendent Barre Town Sewage Treatment Plant c/o Town Office East Barre, Vermont
Bellows Falls	Mr. Cecil Beissonnette Superintendent Bellows Falls Sewage Treatment Plant c/o Town Manager Office Bellows Falls, Vermont
Bennington	Mr. Paul Kelly Superintendent Bennington Sewage Treatment Plant River Road North Bennington, Vermont
Berlin	Superintendent Water Pollution Control Plant M.R. 1 Barre Berlin, Vermont 05641
Brandon	Mr. Burton Baker Superintendent Brandon Sewage Treatment Plant c/o Town Hall Brandon, Vermont
Brattleboro	Mr. Lynton Warden Superintendent Brattleboro Sewage Treatment Plant c/o Town of Brattleboro Fairground Road Brattleboro, Vermont

Municipal Wastewater Treatment Plants
Visited in Vermont (Cont'd)

Plant Location	Mailing Address
Burlington	Mr. John Vincent Superintendent Burlington Sewage Treatment Plant P.O. Box 462 Burlington, Vermont
Castleton	Mr. William Larson Superintendent Castleton Sewage Treatment Plant c/o Castleton Town Office Castleton, Vermont
Cavendish	Superintendent Cavendish Sewage Treatment Plant c/o Town Office Cavendish, Vermont
Colchester - Fire District No. 1	Mr. Patenaude Superintendent Sewage Treatment Plant Colchester Fire District No. 1 Colchester, Vermont
Essex Junction	Mr. Burt Busley Superintendent Essex Junction Sewage Treatment Plant 2 Lincoln Hall Essex Junction, Vermont
Fair Haven	Mr. Louis Faryniarz Superintendent Fair Haven Sewage Treatment Plant c/o Town Hall Fair Haven, Vermont
Hartford	Superintendent Hartford Sewage Treatment Plant c/o Town Hall Hartford, Vermont
Hinesburg	Mr. Henry Hunter Superintendent Hinesburg Sewage Treatment Plant c/o Town Hall Hinesburg, Vermont

Municipal Wastewater Treatment Plants

Visited in Vermont (Cont'd)

Plant Location	Mailing Address
Johnson	Superintendent Johnson Sewage Treatment Plant Village of Johnson Johnson, Vermont 05656
Ludlow	Superintendent Ludlow Sewage Treatment Plant c/o Town Hall Ludlow, Vermont
Manchester Town	Mr. John West Superintendent Manchester Town Sewage Treatment Plant c/o Town Hall Manchester Depot, Vermont
Manchester Village	Mr. Stephen Brisko Superintendent Manchester Village Sewage Treatment Plant c/o Town Hall Manchester Village, Vermont
Middlebury	Mr. Lucius Shaw Superintendent Middlebury Sewage Treatment Plant Seymour Street Middlebury, Vermont
Montpelier	Mr. Walter Peatman Superintendent Montpelier Sewage Treatment Plant Dog River Road Montpelier, Vermont
Newport	Mr. Roger Barow Superintendent Newport Sewage Treatment Plant 269 Union Street Newport, Vermont
Northfield	Superintendent Village of Northfield Sewage Treatment Plant c/o Town Hall Northfield, Vermont

Municipal Wastewater Treatment Plants

Visited in Vermont (Cont'd)

Plant Location	Mailing Address
Plainfield	Mr. Floyd Thompson Superintendent Plainfield Sewage Treatment Plant c/o Town Hall Plainfield, Vermont
Pittsford	Mr. Harold Haveland Superintendent Pittsford Sewage Treatment Plant Pittsford, Vermont
Poultney	Mr. Morris Pansshek Superintendent Poultney Sewage Treatment Plant c/o Town Hall Poultney, Vermont
Proctor	Mr. Raymond Maloney Superintendent Proctor Sewage Treatment Plant c/o Town Clerk's Office Proctor, Vermont
Randolph	Superintendent Randolph Sewage Treatment Plant Randolph, Vermont
Richford	Mr. Robert Shover Superintendent Richford Sewage Treatment Plant Richford, Vermont
Rutland City	Mr. J. R. Carrigan Superintendent Rutland City Sewage Treatment Plant c/o City Hall Washington Street Rutland, Vermont
Rutland Town - Fire District No. 1	Mr. George Miglis Superintendent Sewage Treatment Plant East Proctor Road Center Rutland, Vermont

Municipal Wastewater Treatment Plants

Visited in Vermont (Cont'd)

Plant Location	Mailing Address
St. Albans	Mr. Andrew Assid Superintendent St. Albans Sewage Treatment Plant c/o City Hall St. Albans, Vermont
St. Johnsbury	Town Manager St. Johnsbury, Vermont
Shelburne - Fire District No. 1	Mr. Patrick Moriarity Superintendent Shelburne Fire District No. 1 Sewage Treatment Plant P.O. Box 392 Shelburne, Vermont
Selburne - Fire District No. 2	Mr. Marty Williams Superintendent Shelburne Fire District No. 2 Sewage Treatment Plant Shelburne, Vermont
South Burlington	Mr. Don Whitten Superintendent Sewage Treatment Plant 1175 Wilson Road South Burlington, Vermont
Springfield - Clinton Street	Mr. Anthony Nunes Springfield Sewage Treatment Plant c/o Municipal Building 96 Main Street Springfield, Vermont
Springfield - Fairground Road	See Springfield - Clinton Street
Vergennes	Superintendent Vergennes Sewage Treatment Plant c/o Town Hall Vergennes, Vermont
Waterbury	Mr. Fifield Superintendent Waterbury Sewage Treatment Plant Waterbury, Vermont

Municipal Wastewater Treatment Plants
Visited in Vermont (Cont'd)

Plant Location	Mailing Address
West Rutland	Mr. Robert Kupferrer West Rutland Sewage Treatment Plant c/o Town of West Rutland West Rutland, Vermont
Williamstown	Mr. Tom Jarvis Williamstown Sewage Treatment Plant c/o Town Hall Williamstown, Vermont
Wilmington	Mr. Steve Lazelle Superintendent Wilmington Sewage Treatment Plant Fairview Avenue Wilmington, Vermont
Windsor	Superintendent Windsor Sewage Treatment Plant c/o Town Hall Windsor, Vermont
Woodstock	Superintendent Woodstock Sewage Treatment Plant c/o Town Hall Woodstock, Vermont
Burlington - North	Mr. John Vincent Superintendent Burlington North Sewage Treatment Plant P.O. Box 462 Burlington, Vermont
Burlington - Riverside	See Burlington - North
Chester	Mr. John Whittiker Chester Sewage Treatment Plant c/o Town Hall Chester, Vermont
South Burlington - Phase IV	Mr. Don Whitten Superintendent South Burlington Phase IV Sewage Treatment Plant 1175 Wilson Road South Burlington, Vermont

Municipal Wastewater Treatment Plants
Visited in Vermont (Cont'd)

Plant Location	Mailing Address
Winooski	Mr. Foster Superintendent West Allen Street Winooski

APPENDIX B

FORM A

1. Establishment Number: This number consists of 13 digits. The first two digits identify which state a plant is in; i.e., 09 stands for Connecticut, etc. The next nine digits identify a specific plant, while the last two digits identify the county in which the plant is located. The middle nine digits (digits 3-11) conform with the EPA's Master City File Directory listing of plants.

State Code	Plant Code	County Code
09	173300001	99

State Code:	09	Connecticut
	23	Maine
	25	Massachusetts
	33	New Hampshire
	44	Rhode Island
	50	Vermont

2. Name and Location: Name and location of the plant surveyed. (T) signifies that the plant is a municipal plant.

INDEX DATA

CATEGORY	CODE	COLUMNS From	COLUMNS Thru	Number Columns
1. Establishment #		1	13	13
2. Name, Location		15	60	46
3. Card Type	A	80		1

FORM B-1

1. Establishment Code: See explanation under Form A establishment on page

2. Basin Code: Identifies into which water basin a plant discharges. The first two digits are the major basin code; the last two, the minor basin code.

3. Type of Treatment: The code used as follows --

20	Primary -- setting tanks with no detail
21	Primary -- septic tanks
22	Primary -- Imhoff tanks
23	Primary -- mechanically cleaned tanks
24	Primary -- plain, hopper bottom tanks
29	Primary -- others and unknown
30	Chemical
41	Secondary -- activated sludge
42	Secondary -- extended aeration
43	Secondary -- biological filters fixed nozzle
44	Secondary -- biological filters rotary
45	Secondary -- intermittent sand filter
46	Secondary -- land disposal
47	Secondary -- lagoons
48	Secondary -- biological
49	Secondary -- others and unknown
50	Other (specify)

4. Population Served: This is an estimate of the number of people presently sewered. It is not the number of tie-ins nor is it the population of the municipality served.

Code	1	under 499
	2	500-999
	3	1,000-4,999
	4	5,000-9,999
	5	10,000-24,999
	6	25,000-49,999
	7	50,000-99,999
	8	100,000-249,999
	9	250,000-499,999
	0	500,000- and over

5. MGD -- yearly average: is an estimate of how many million gallons a day the plant will average in the fiscal year 1972-73.

   MGD -- capacity: how many million gallons of sewerage a plant could feasibly handle on any given day in fiscal '72.
6. Current Full Time: the number of men, including EEA workers, who were currently working full time at a given plant on the day of inspection (inspection sometime between June 1, 1972, and August 1, 1972).
7. Current Part Time: the number of men working part time schedules at a given plant on the day of inspection.
8. Authorized Full Time: the number of full time men which is authorized by the municipal budget. Does not include any full time workers under programs such as the EEA or STEP because they are paid with federal monies.
9. Authorized Part Time: the number of part time men which is authorized by the municipal budget. Does not include any part time workers under programs such as the EEA or STEP because they are paid with federal monies. Does not include seasonal workers.
10. Recommended Full Time: contracting engineer's recommendation for the number of men needed to run a given plant; when available.
11. Recommended Part Time: contracting engineer's recommendation for the number of part time men needed to run a given plant.
12. Seasonal: the number of workers hired to help handle peak summer work loads. These workers often maintain the

grounds or do other similar tasks. They are usually hired for nine to twelve week periods and never continue working into the winter months unless they are hired full or part time.

13. Year Ago Full Time: the number of full time workers at the plant one year prior to the day of inspection.
14. Year Ago Part Time: the number of part time workers at the plant one year prior to the day of inspection.
15. Number New Hirees: the number of men hired in the preceding year (typically 7/71-7/72) to replace workers who left or to fill new positions created in the past year.
16. Number of Separations: the number of men who have left the plant in the past year due to quits, deaths, retirements, firings, and other reasons.
17. Number of Vacancies: the number of funded job openings which the management of the plant is actively seeking to fill
18. Self-explanatory
19. Self-explanatory
20. Overtime A: the average number of overtime hours worked at a plant in any week

    Overtime B: (1) overtime is year round

    (2) overtime is seasonal
21. Year Plant Constructed: the year in which construction of the plant was completed whereupon the plant went into operation.
22. Year of Last Addition: the year in which the construction of the last major addition was completed.

B-1 PLANT QUESTIONNAIRE

Place

Date

Interviewer

	Code	Column
1. Establishment #		
2. Basin Code		
3. Type of Treatment		
4. Population Served		
5. MGD -- yearly average		
capacity		
6. Current Full Time		
7. Current Part Time		
8. Authorized Full Time		
9. Authorized Part Time		
10. Recommended Full Time		
11. Recommended Part Time		
12. Seasonal		
13. Year Ago Full Time		
14. Year Ago Part Time		
15. # New Hirees Preceding Year		
16. (Separations)		
A. Total		
B. Quits		
C. Deaths		
D. Retirements		
E. Firings		
F. Other		
17. # of Vacancies		

B-1 PLANT QUESTIONNAIRE (Cont'd)

	Code	Column
18. Reasons for Vacancies		
A. Qualified Personnel N.A.		
B. Pay not Adequate		
C. Inadequate Transportation		
D. Undesirable Working Cond.		
E. In Process of Hiring		
F. Other		
19. One Month or More		
20. Overtime		
A. Hours/Week		
B. Weeks/Year		
21. Year Plant Constructed		
22. Year of Last Addition		

B-2 EMPLOYEE QUESTIONNAIRE

CATEGORY	CODE	COLUMNS	COMMENTS
1. Establishment code			
2. Their occupation title			
3. Our occupation title			
4. Distance to work			
5. Age			
6. Education (no. years)			
7. Formal training a. name of school b. no. hrs.			
a. b.			
a. b.			
a. b.			
a. b.			
8. Certified by whom a. grade			
9. Civil Service			
10. Unionized			
11. E.E.A.			
12. Length in WW ind.			
13. Worked in other WW plants			
14. Were you promoted a. within plant b. plant to plant			

B-2 EMPLOYEE QUESTIONNAIRE (Cont'd)

CATEGORY	CODE	COLUMNS	COMMENTS
15. Last previous employment outside of WW			
16. Salary			
a. by hour			
b. by week			
c. by year			
17. Moonlighting			
a. no. hrs.			
b. type job			
18. Comments			

FORM B-2

1. Self-explanatory
2. Self-explanatory
3. Self-explanatory
4. Self-explanatory
5. Self-explanatory
6. Self-explanatory
7. a. Self-explanatory

   b. Extent of Training:

      0 ---- none*
      1 ---- two short courses or less than 120 hours*
      2.---- three to five short courses or 120-240 hours*
      3 ---- six to ten short courses or 240-400 hours*
      4 ---- one full academic year, more than ten short courses or greater than 400 classroom hours*

      * or equivalent

8. Certified:

      1 yes
      0 no
      99 not available

   a. By whom -- refer to state code

   b. Grade: what level the certified operator is.

9. Civil Service:

      0 no
      1 yes
      N not available

10. Union Membership:

      0 no
      1 yes
      N not available

11. EEA: employed under the Emergency Employment Act.

0	no
1	yes
N	not available

12. Length in Industry: the number of years a worker has been in the waste water industry.

--- 00 implies less than 1 full year

--- all other figures rounded to the nearest year

13. Worked in Other (Sewerage) Plants

0	no
1	yes
N	not available

14. Promoted: a promotion was any change in status involving a change in job title accompanied by an increase in pay. Promotions were of two types -- inter and intra plant.

0	no
1	yes
N	not available

15. Last Previous Employment Outside the Waste Water Industry: the code used follows --

By Industry

01	None
02	Military Service
03	Department of Public Works
04	City Service
05	Shoe Industry
06	Railroads
07	Paper Mill
08	Agriculture
09	Construction
10	General Manufacturing (Factory)
11	Retail Sales

By Occupation

20 Skilled Worker
21 Unskilled Worker
22 Building Construction (Electrician, Carpenter)
23 Plumber
24 White Collar
25 Engineer
26 Mechanic or Machine Work
27 Other

16. Salary:

a. weekly salary to the nearest dollar

b. number of hours worked per week

c. not used

JOB DEFINITIONS

Following are the job definitions utilized in BURG study. Due to the different degree of complexity between small and large plants, a greater number of job categories are found for those plants having more than ten employees.

Large Plants

Superintendent

Responsible for administration, operation, and maintenance of entire plant. Exercises direct authority over all plant functions and personnel, in accordance with approved policies and procedures. Inspects plant regularly. Analyzes and evaluates operation and maintenance functions; initiates or recommends new or improved practices. Develops plans and procedures to ensure efficient operation of present plant and provide for projected future requirements. Recommends plant improvements and additions. Co-ordinates data and prepares or reviews and approves operation reports and budget requests. Controls expenditures, if required. Recommends specifications for major equipment and material purchases. Organizes and directs activities of plant personnel. Maintains effective communications and working relationships with employees, government officials, and general public. Designated as Superintendent I or II depending upon size and complexity of plant.

Assistant Superintendent

Assists in administrative engineering and supervisory duties, under general direction of superintendent. Serves as superintendent in his absence. Aids in analyzing and evaluating operating and maintenance procedures, and in developing new or improved practices. Participates in maintenance of operating records, compilation of data, and report preparation. Assists in employee training. Inspects plant. Assists in planning special maintenance work and minor plant alterations. Designated Assistant Superintendent I or II, depending upon size and complexity of plant.

Clerk Typist

Performs any combination of following tasks and/or other clerical duties. Operates typewriter and other standard office machines and equipment; including adding machine, calculator, and duplicating machine. Serves as secretary to superintendent. Acts as receptionist. Responsible for personal work determination in accordance with established precedent or policy. Sets up simple office routines and filing systems. Minor supervisory responsibilities. Composes routine correspondence. Answers telephone and handles routine inquiries from public. Typing includes tables, reports, requisitions, forms and other material from copy, draft, or dictating machines; frequently involving judgment regarding format or information to be included. Clerical duties include maintaining financial records not requiring technical bookkeeping skills. Duties ordinarily include posting, filing/sorting, and other routine clerical functions.

Operations Supervisor

Supervises and coordinates activites of plant operators, laborers, custodians, and/or laboratory personnel. Prepares work schedules, subject to approval of superintendent or assistant. Analyzes recording instrument readings and laboratory test results, adjusts various plant processes accordingly. Prepares reports and maintains records. Inspects plant to determine efficiency or operation, cleanliness, and maintenance requirements. Instructs and directs operators. Determines remedial action in emergencies. Conducts training program. Requisitions chemicals and supplies. Performs duties of assistant superintendent in his absence.

Shift Foreman

Supervises operation of plant, under general direction of superiors. Performs duties of maintenance supervisor or foreman in their absence. Supervises, instructs, and assigns specific duties to shift workers. Reviews and evaluates work performance. Participates in training programs. Inspects plant equipment and processes regularly. Analyzes instrument readings and laboratory test results. Determines site and causes of any malfunctions. Orders, supervises, or participates in required adjustments or repairs. Maintains and evaluates operating records. Replaces operator or maintenance worker during emergency situations. Communicates with other shift foremen regarding plant conditions.

Operator II

Performs any combination of following tasks pertinent to controlling operation of plant. Operates wastewater treatment, sludge processing, and disposal equipment to control flow and processing of wastewater, sludge, and effluent. Monitors gauges, meters, and control panels. Observes variations in operating conditions and interprets meter and gauge readings and test results to determine processing requirements. Operates valves and gates either manually or by remote control and adjusts flow and treatment process. Maintains shift log and records meter and gauge readings. Extracts samples and performs routine laboratory tests and analyses. Performs routine maintenance functions and custodial duties. Operates and maintains power generating equipment and incinerators. Classified by titles such as Pump Station Operator or Digestor Operator when performing specialized activities only.

Maintenance Supervisor

Supervises all preventive and corrective maintenance on plant and equipment. Plans, schedules, and directs maintenance of wide variety of specialized mechanical and electrical equipment plus buildings, structures, and grounds. Inspects plant frequently to ensure proper maintenance procedures. Determines necessity for and establishes long-range maintenance programs. Decides remedial action in emergency situations. Assigns work to Mechanical Maintenance Foremen and Electricians. Supervises and instructs maintenance personnel. Supervises installation and testing of new or rebuilt equipment. Supervises inspection of subcontracted maintenance work. Submits maintenance budget requests. Supervises maintenance records. Performs related work as required.

Mechanical Maintenance Foreman

Supervises mechanical maintenance crew in performance of side variety of maintenance and repair tasks on machinery, equipment, buildings, structures, and grounds. Duties include any combination of tasks such as the following: Assigns tasks to maintenance crew. Directs and/or participates in maintenance and repair tasks as required; Supervises and instructs maintenance personnel on routine and emergency tasks; Consults superiors regarding preventive program; Inspects plant and mechanical equipment for malfunctions and needed repairs; Determines repair methods; Consults with superior and/or manufacturer's representatives on difficult or complicated repairs; Keeps maintenance records; Works with subcontractors.

Maintenance Mechanic II

Performs preventive maintenance and repairs on mechanical and electro-mechanical machinery and equipment, under general direction of superior. Maintains buildings, structures, and grounds. Duties include any combination of tasks such as following: Lubricates equipment and checks for malfunctions; Replaces packing in pumps or valves; Replaces bearings in motors, pumps, and other equipment; Adjusts and cleans bar screens, comminutors, and weir plates; Cleans out pipes and performs other plumbing and pipefitting tasks as required; Uses gas and/or arc welding equipment to heat, cut, braze, or weld; Performs duties of electrician and/or painter in their absence; Relines incinerator with firebrick; Installs and sets up new equipment; Assists in keeping maintenance records; supervises, instructs, and inspects work of Mechanic I, Operator-Mechanic, Maintenance Worker, or Laborer to ensure proper performance of maintenance work or repairs. Performs general maintenance and repair tasks on buildings, structures, and grounds.

Maintenance Mechanic I

Performs or assists in performance of preventive maintenance and repairs on mechanical and electro-mechanical machinery and equipment, under direction of Mechanic II, foreman, or Supervisor. Maintains buildings, structures, and grounds. Duties include any combination of tasks such as following: Lubricates motors and equipment and checks for malfunction; Replaces packing in pumps and valves; Replaces bearings in motors, pumps, and other equipment; Adjusts and cleans bar screens, comminutors, and weir plates; Installs and sets up new equipment; Cleans out pipes and performs other plumbing and pipefitting tasks as required; Uses gas and/or arc welding equipment to heat, cut, braze, or weld; Performs duties of electrician and/or painter in their absence; Assists Mechanic II and/or Foreman on difficult or highly complicated maintenance or repair tasks; Performs general maintenance and repair tasks on buildings, structures, and grounds -- including limited laboring and custodial tasks; Assists in keeping maintenance records.

Maintenance Helper

Assists maintenance mechanics in maintaining and repairing equipment, machinery, buildings, and grounds. Duties include any combination of tasks such as following: Cleans and lubricates pumps, motors, and related equipment; Assists in removing, repairing, and replacing equipment as directed; Performs routine building maintenance work; Performs simple repairs and adjustments to equipment; Keeps simple records; Carries or holds material, supplies, or tools to assist mechanics, electricians, or painters; Performs laborer tasks as required.

Electrician II

Inspects, repairs, and maintains electrical and/or electronic operating and control systems, equipment, and fixtures; including instrumentation and heating and cooling systems. Exercises independent judgment in solving normal work problems under general supervision of maintenance supervisor or assistant supervisor, uses standard and special electrical tools and equipment, such as voltmeters, ammeters, and synchroscopes. Duties include any combination of tasks such as following: Inspects, maintains and repairs wiring and lighting systems, electrical control equipment meters, outlets, and panels; Installs new equipment; Interprets oral and written instructions, specifications, wiring diagrams and codes; Supervises Electrician I, Maintenance Helper, and/or Laborer; Establishes and operates scheduled maintenance program for plant equipment; Repairs electrical and electronic instruments; Keeps maintenance records; Prepares labor and material estimates.

Electrician I

Participates in installation, maintenance, and repair of the electrical systems, equipment, and fixtures. Assists the Electrician II in particularly difficult or complicated tasks. Work frequently performed independently, subject to inspection by superiors. Follows oral and written instructions including specifications, wiring diagrams, and codes. Duties include any combination of tasks such as following: Inspects, maintains, and repairs wiring and lighting systems, electrical control equipment, meters, outlets, and panels; Installs new equipment; Supervises maintenance helper and/or laborer; Repairs electrical instruments; Keeps maintenance records.

Chemist

Supervises and performs specialized and complex chemical, bacteriological and physical tests and analyses of raw, partially treated, and treated wastewater and by-products to determine efficiency of plant processes and ensure that plant affluent meets local, state, and federal requirements. Conducts or supervises less complex routine tests. Supervises collection of laboratory samples. When laboratory technician is present, supervises technician and provides routine procedures to be followed. Evaluates and interprets test results, establishes test priorities, prepares reports, and supervises laboratory technicians. Assembles data, maintains records, and prepares periodic reports. Sets up pilot processes when conducting research on improved procedures. Provides direct or indirect instructions to operating personnel regarding chemical requirements and adjustments, changes, or additions to various treatment processes. Classified as Chief Chemist, Chemist I or Chemist II, or Research Chemist according to function performed.

Laboratory Technician

Performs any combination of the following routine laboratory tasks as instructed by Chemist. Collects samples of plant influent, partially treated wastewater, sludge, effluent, and other by-products. Assembles instruments, and equipment for analytical or research work. Prepares chemical and bacteriological media, stains reagents, and test solutions routinely used in laboratory. Operates equipment and conducts tests as directed. Maintains test result records, prepares data sheets. Prepares or assists in preparation of reports. Cleans, maintains and stores instruments and equipment. Maintains inventory and orders supplies. Performs custodial duties in laboratory. Operates laboratory in small primary treatment or trickling filter plant in absence of Chemist.

Storekeeper

Requisitions, receives, stores, and issues supplies, tools, and equipment. Maintains inventory records and controls. Duties include any combination of tasks such as following: Inspects incoming stock to verify quantity, quality, and adherence to specifications; Identifies and stores material; Fills orders and issues supplies from stock; Prepares periodic or perpetual inventory; Requisitions replacement quantities of stock items as necessary; Compiles records and reports of material used, spoilage or other loss, inventory adjustments, and refusal of shipments; Recommends changes in established procedures; Determines methods of storage, identification, and location of stock; Divides stock quantities into portions to fill orders.

Automotive Equipment Operator

Operates automotive equipment such as dump truck, tank truck, fork lift, or tractor to perform any combination of tasks such as following: Loads or assists in loading grit, sludge, or other disposable material; Hauls material from plant to disposal area; Unloads material at destination; Operates tractor to cut grass or weeds, bulldoze soil, or remove soil; Performs maintenance on vehicles.

Custodian

Cleans all or designated portions of wastewater treatment plant and ground. Performs any combination of tasks such as following in accordance with established procedures, subject to inspection for adherence to required standards of cleanliness and compliance with instructions. Sweeps, mops, waxes, and polishes floors; washes walls, and woodwork; dusts furniture, piping, valves, etc. Washes and polishes windows and metal surfaces. Cleans restrooms and maintains supplies. Empties wastecans and ashtrays. Polices and performs general custodial duties on grounds, including picking up litter and sweeping walks. May shovel snow and cut grass. Adjusts heat and air conditioning controls. Reports any repairs or adjustments required. Acts as watchman. Washes and polishes cars and trucks.

Painter

Under general supervision of Maintenance Foreman or Shift Foreman, performs all types of painting work, including any combination of tasks such as following: Prepares various surfaces for painting by washing, scraping, burning, sand-blasting or other means as necessary; Mixes, matches, and blends various paints, enamels, lacquers, varnishes, stains and special protective coatings to achieve desired color, consistency, and drying properties; Caulks, putties, cements, or plasters holes and cracks; Cuts and replaces glass in windows and doors; Erects and uses ladders, scaffolding, and swinging stage equipment as required; Paints buildings, structures, equipment, and furniture, using brush, roller, spray gun or other applicator; Prepares wall and hangs paper or other wall-covering material; Performs simple sign-painting using stencils; Requisitions material and equipment; Cleans and stores tools and equipment; Cleans up work site or arranges for laborer to clean up.

Laborer

Performs any combination of following tasks in Wastewater Treatment Plant: Cleans equipment such as bar screens, comminutors, and weirs; Lubricates machinery; Loads and unloads trucks; Spreads sand, gravel, and dirt; Paints (rough) and performs other minor maintenance; Digs and refills ditches; Cleans drains, ditches, and culverts; Cuts grass, weeds, and brush; Trims trees and bushes; Rakes grass, leaves, and trash; Seeds and cares for lawn and ornamental plantings; Removes snow and ice from walkways, driveways, and equipment; Collects and disposes of trash and garbage; Washes and cleans vehicles, tools, and equipment; Carries or holds material, supplies, or tools to assist maintenance personnel.

Small Plants

The number of job categories for small plants is limited due to the lack of rigidly defined job duties in these facilities. Many of these plants were characterized either by a single operator or a labor force consisting of individuals who performed similar, if not exact, tasks. Virtually every individual in a small plant was capable of performing any function, exclusive perhaps of lab work.

Operations Supervisor

Responsible for the administration, operation, and maintenance of the entire plant. Prepares work schedules, analyzes recording instrument readings and laboratory test results, and adjusts various plant processes accordingly. Prepares reports and maintains records. Instructs and directs operators. Conducts training programs. Requisitions chemicals and supplies. In addition, performs some of the tasks of an operator. Although he is the administrator of the plant, he is often times under the jurisdiction of the superintendent of a combined sewer and water department, or some other similar arrangement.

Sole Operator

Category assigned to these individuals who are the sole employee of a plant.

Operator

Performs any combination of following tasks pertinent to controlling operation of plant. Operates wastewater treatment, sludge processing, and disposal equipment to control flow and processing of wastewater, sludge, and effluent. Monitors gauges, meters, and control panels. Observes variations in operating conditions and interprets meter and gauge readings and test results to determine processing requirements. Operates valves and gates either manually or by remote control; starts and stops pumps, engines and generators to control and adjust flow and treatment processes. Maintains shift log and records meter and gauge readings. Extracts samples and performs routine lab tests and analyses. Performs routine maintenance functions and custodial duties. Operates and maintains power generating equipment and incinerators.

Laborer

Performs any combination of following tasks in wastewater treatment plant. Cleans equipment such as bar screens, comminutors, and weirs. Lubricates machinery, Loads and unloads trucks; spreads sand,gravel, and dirt. Drives truck. Paints (rough) and performs other minor maintenance. Digs and refills ditches. Cleans drains, ditches, and culverts. Cuts grass, weeds, and brush; trims trees and brush; rakes grass, leaves, and trash; seeds and cares for lawn and ornamental plantings. Removes snow and ice from walkways, driveways, and equipment. Collects and disposes of trash and garbage. Washes and cleans vechicles, tools, and equipment. Carries or holds material, supplies, and tools to assist maintenance personnel.

APPENDIX C

Information regarding certification of operators of wastewater treatment plants may be obtained from:

Connecticut

Mr. Joseph J. Cosman
Connecticut Department of Environmental Protection
Hartford, Connecticut 06115

Maine

Mr. Charles H. King
Department of Environmental Protection
Augusta, Maine 04330

Massachusetts

Mr. Thomas C. McMahon, Director
Massachusetts Division of Water Pollution Control
Boston, Massachusetts 02202

New Hampshire

Mr. Richard Grossman
New Hampshire Water Supply & Pollution Control Commission
Concord, New Hampshire 03301

Rhode Island (reference)

Mr. Hagop Bohosian
Division of Water Supply & Pollution Control
Providence, Rhode Island 02908

Vermont

Mr. William Albert, Director
Water Supply and Pollution Control Commission
Montpelier, Vermont 05602

Mr. Alfred Peloquin, Executive Secretary
New England Interstate Water Pollution Control Commission
607 Boylston Street
Boston, Massachusetts 02116

Certification Committee
New England Water Pollution Control Association
Dr. Hamdy Bechir, Chairman
c/o Charles A. McGuire Associates
860 Silas Dean Highway
Wethersfield, Connecticut 06109

APPENDIX D

Regression Equation on Certification

Dependent Variable y = Certification

Independent Variable x_1 = years of education

x_2 = extent of training

x_3 = years in wastewater industry

Connecticut

$$y = .065 + .0001x_1 + .2x_2 + .004x_3$$

(.13) (12.4) (2.3)*
(.006) (.65) (.11)**

Maine

$$y = .423 - .01x_1 + .19x_2 + .04x_3$$

(-1.3) (4.9) (3.8)
(1.2) (.47) (.35)

Massachusetts

$$y = .06 - .001x_1 + .19x_2 + .0001x_3$$

(-.148) (8.4) (2.1)
(.008) (.48) (.14)

* t-values are shown below the independent variable

**Variables and the Beta Coefficient are shown below the t's.

Certification Cont'd.

New Hampshire

$$y = -.065 + .007x_1 + .09x_2 + .005x_3$$

$$\begin{array}{ccc} (.61) & (3.2) & (2.0) \\ (.06) & (.32) & (.20) \end{array}$$

Rhode Island

$$y = -.055 - .02x_1 + .65x_2 + .007x_3$$

$$\begin{array}{ccc} (-.5) & (17.0) & (1.4) \\ (.02) & (.70) & (.06) \end{array}$$

Vermont

$$y = -.285 + .02x_1 + .19x_2 + .001x_3$$

$$\begin{array}{ccc} (1.2) & (4.1) & (1.1) \\ (.12) & (.47) & (.11) \end{array}$$

Superintendent

$$y = .201 - .02x_1 + .18x_2 + .005x_3$$

$$\begin{array}{ccc} (-1.01) & (3.14) & (.63) \\ (.15) & (.47) & (.09) \end{array}$$

Operation Supervisor

$$y = .264 + .01x_1 + .16x_2 + .002x_3$$

$$\begin{array}{ccc} (.85) & (5.38) & (.66) \\ (.06) & (.38) & (.04) \end{array}$$

Sole Operator

$$y = .004 + .002x_1 + .17x_2 + .02x_3$$

$$\begin{array}{ccc} (.17) & (3.2) & (2.2) \\ (.02) & (.25) & (2.2) \end{array}$$

Operator

$$y = .012 - .001x_1 + .30x_2 + .007x_3$$

$$\begin{array}{ccc} (-1.47) & (10.47) & (2.08) \\ (.08) & (.57) & (.11) \end{array}$$

Regression Equation For Promotions

Dependent Variable y = promotions

Independent Variable x_1 = extent of training

x_2 = Certification

x_3 = grade of certification

x_4 = years in wastewater industry

Superintendent

$$y = .4 - .2x_1 - .5x_2 + .2x_3 + .01x_4$$

(-2.5) (-1.4) (2.2) (1.7)*
(-0.4) (-0.4) (0.7) (0.2)

Assistant Superintendent

$$y = .7 - .5x_1 + 3.7x_2 - .8x_3 + .02x_4$$

(-3.7) (3.9) (-3.5) (1.7)
(-1.3) (3.7) (-3.3) (0.4)

Operations Supervisor

$$y = .3 - .01x_1 - .2x_2 + .9x_3 + .01x_4$$

(-0.3) (-1.4) (2.0) (2.4)
(-0.03)(-0.2) (0.3) (0.2)

Sole Operator

$$y = .2 + .2x_1 - .3x_2 + .1x_3 + .03x_4$$

(3.7) (-2.2) (1.2) (3.9)
(0.5) (-0.3) (0.2) (0.5)

Foreman

$$y = .4 + .1x_1 - .1x_2 + .1x_3 + .01x_4$$

(.9) (-1.5) (1.2) (1.8)
(.2) (-0.4) (0.2) (0.3)

*t values are shown below the independent variables, and the Beta coefficients are shown below the t's.

Promotions Cont'd.

Operator

$$y = .2 - .03x_1 + .1x_2 + .02x_3 + .02x_4$$

(-0.7) (0.5) (0.3) (4.8)
(-0.05)(0.09) (0.04) (0.31)

Skilled Maintenance

$$y = .3 + .2x_1 - 1.2x_2 + .3x_3 + .02x_4$$

(1.6) (-1.1) (0.6) (2.8)
(0.2) (-0.6) (0.3) (0.3)

Laborer

$$y = .03 + .1x_1 + .9x_2 - .3x_3 + .02x_4$$

(1.5) (2.1) (-1.8) (4.7)
(0.1) (0.5) (-0.4) (0.3)

Connecticut

$$y = .2 - .06x_1 + .5x_2 - .06x_3 + .01x_4$$

(-1.5) (2.6) (-1.1) (3.9)
(-0.1) (0.5) (-0.2) (0.2)

Maine

$$y = -.02 + .03x_1 - .1x_2 + .01x_3 + .03x_4$$

(1.2) (-1.1) (0.6) (2.7)
(0.2) (-0.2) (0.1) (0.3)

Massachusetts

$$y = .2 + .1x_1 - .4x_2 + .1x_3 + .03x_4$$

(3.8) (-2.3) (1.5) (6.9)
(0.3) (-0.3) (0.2) (0.4)

New Hampshire

$$y = .3 + .1x_1 - .1x_2 + .1x_3 + .01x_4$$

(0.9) (-1.3) (1.1) (1.9)
(0.2) (-0.2) (0.1) (0.2)

Promotions Cont'd.

Rhode Island

$$y = .2 + .1x_1 - .2x_2 + .02x_3 + .02x_4$$

(2.2) (-2.2) (0.6) (4.1)
(0.3) (-0.3) (0.1) (0.3)

Vermont

$$y = .1 + .004x_1 + .06x_2 - .01x_3 + .02x_4$$

(0.1) (0.2) (-0.1) (2.8)
(0.01) (0.6) (-0.02) (0.3)

Regression Equations On Salaries

Dependent Variable y = salary

Independent Variable x_1 = years of education

x_2 = extent of training

x_3 = certification

x_4 = unionization

x_5 = years in wastewater industry

Superintendent

$$y = -53.9 + 21.4x_1 - 7.3x_2 + 17.9x_3 - 56.8x_4 + 2.4x_5$$

(6.2) (-1.0) (0.9) (-2.4) (2.6)*
(.76) (- .14) (.13) (- .31) (.36)

Assistant Superintendent

$$y = 214.9 - 16.7x_1 + 24.4x_2 + 127.8x_3 - 111.4x_4 + 7.2x_5$$

(-3.4) (3.9) (3.4) (-5.2) (9.7)
(- .75) (.45) (.80) (- .69) (1.02)

Sole Operator

$$y = 114.1 - 1.6(x_1) + 12.6(x_2) + 14.7(x_3) + 8.1(x_4) + 1.2(x_5)$$

(-0.4) (1.7) (-0.9) (0.3) (0.9)
(-0.1) (0.29) (0.16) (.05) (0.14)

Foreman

$$y = 137.4 + 1.9x_1 + 8.9x_2 + 13.9x_3 - 5.2x_4 + .6x_5$$

(0.9) (2.6) (1.8) (-0.7) (1.6)
(.12) (.44) (.28) (-0.10)(0.21)

Operator

$$y = 102.8 + 1.4x_1 + 7.0x_2 - .5x_3 + 10.8x_4 + 1.3x_5$$

(1.7) (3.4) (-0.1) (2.4) (4.2)
(.11) (.24) (.01) (.16) (.29)

* t values are shown below the independnet variables and the Beta coefficients are below the t's.

Salaries Cont'd.

Skilled Maintenance

$$y = 152.1 + .4x_1 + 21.4x_2 - 37.8x_3 + 8.4x_4 - .5x_5$$

$$\begin{array}{lllll} (0.6) & (1.2) & (-0.9) & (0.4) & (-0.3) \\ (\ .07) & (\ .15) & (-\ .11) & (\ .04) & (-\ .03) \end{array}$$

Chemists

$$y = 42.5 + 7.0x_1 + 1.3x_2 + 8.9x_3 + .1x_4 + 2.3x_5$$

$$\begin{array}{lllll} (3.5) & (0.3) & (0.7) & (0.0) & (3.8) \\ (\ .43) & (\ .03) & (\ .08) & (\ .00) & (\ .44) \end{array}$$

Laborers

$$y = 99.8 + 1.5(x_1) - 7.0x_2 + 4.7x_3 + 7.2x_4 + 1.1x_5$$

$$\begin{array}{lllll} (1.8) & (-1.8) & (0.4) & (1.9) & (3.4) \\ (\ .14) & (-\ .13) & (\ .03) & (\ .14) & (\ .28) \end{array}$$

Operations Supervisor

$$y = 102.7 + 3.8x_1 + 5.5x_2 + 22.0x_3 + 2.9x_4 + .9x_5$$

$$\begin{array}{lllll} (1.1) & (0.9) & (1.6) & (0.2) & (1.1) \\ (\ .08) & (\ .08) & (\ .13) & (\ .01) & (\ .09) \end{array}$$

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